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JOURNAL OF

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MARCH
1961

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Journal of Agriculture

Vol. 102 No. 3 15 March 1961
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Cover

Harvesting of the grape crop is now well under way on New Zealand's 1,000 acres of commercial vineyards. In addition to table grapes these produce about 800,000 gallons of wine a year. Though fortified wines such as sherry still predominate, there has been a steady increase in the production of table wines, some very good Sauterne-type wines being produced at reasonable cost.

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Mid-Dome Conservation Project

Rehabilitation of Southland Eroded High Country

By

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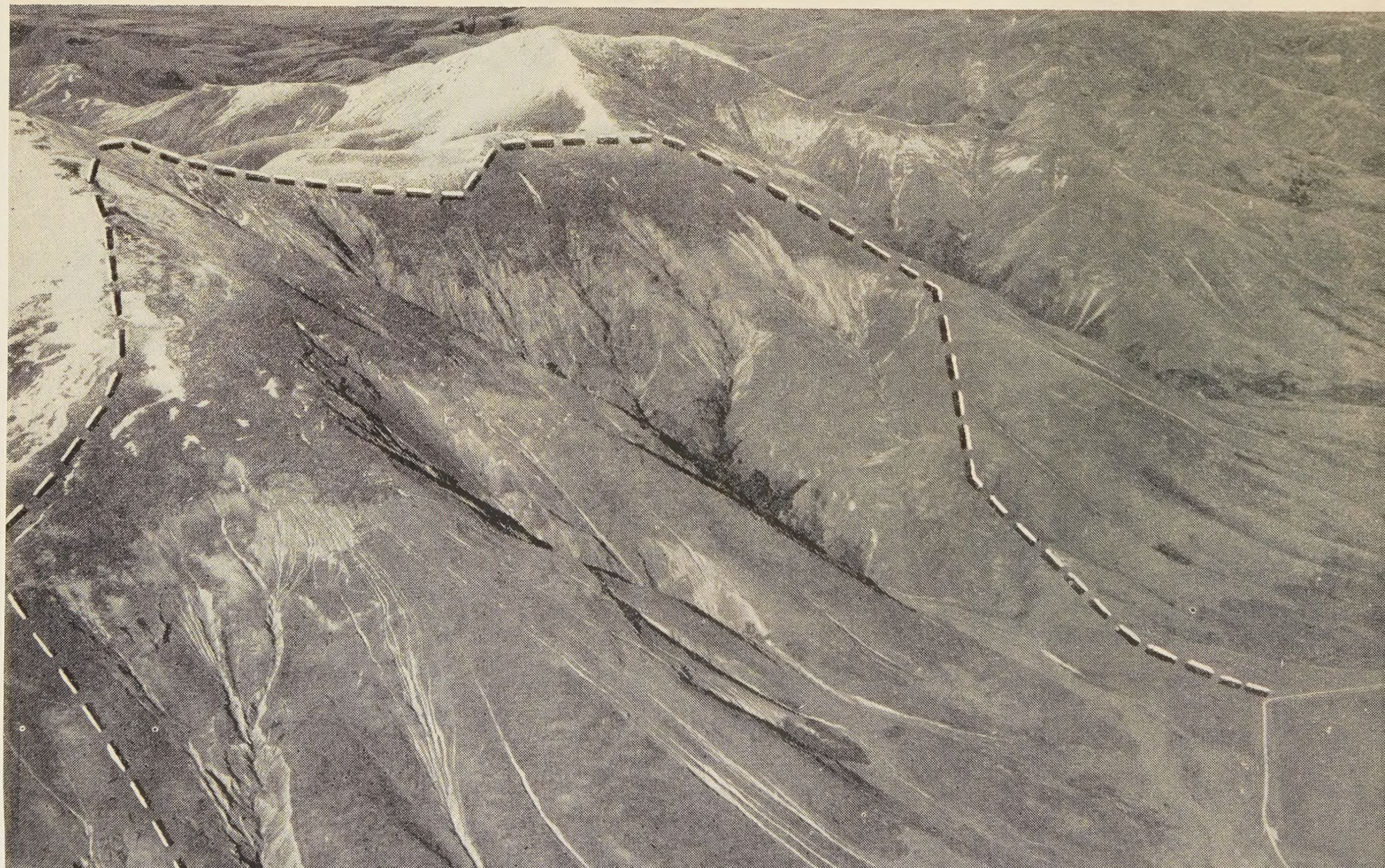
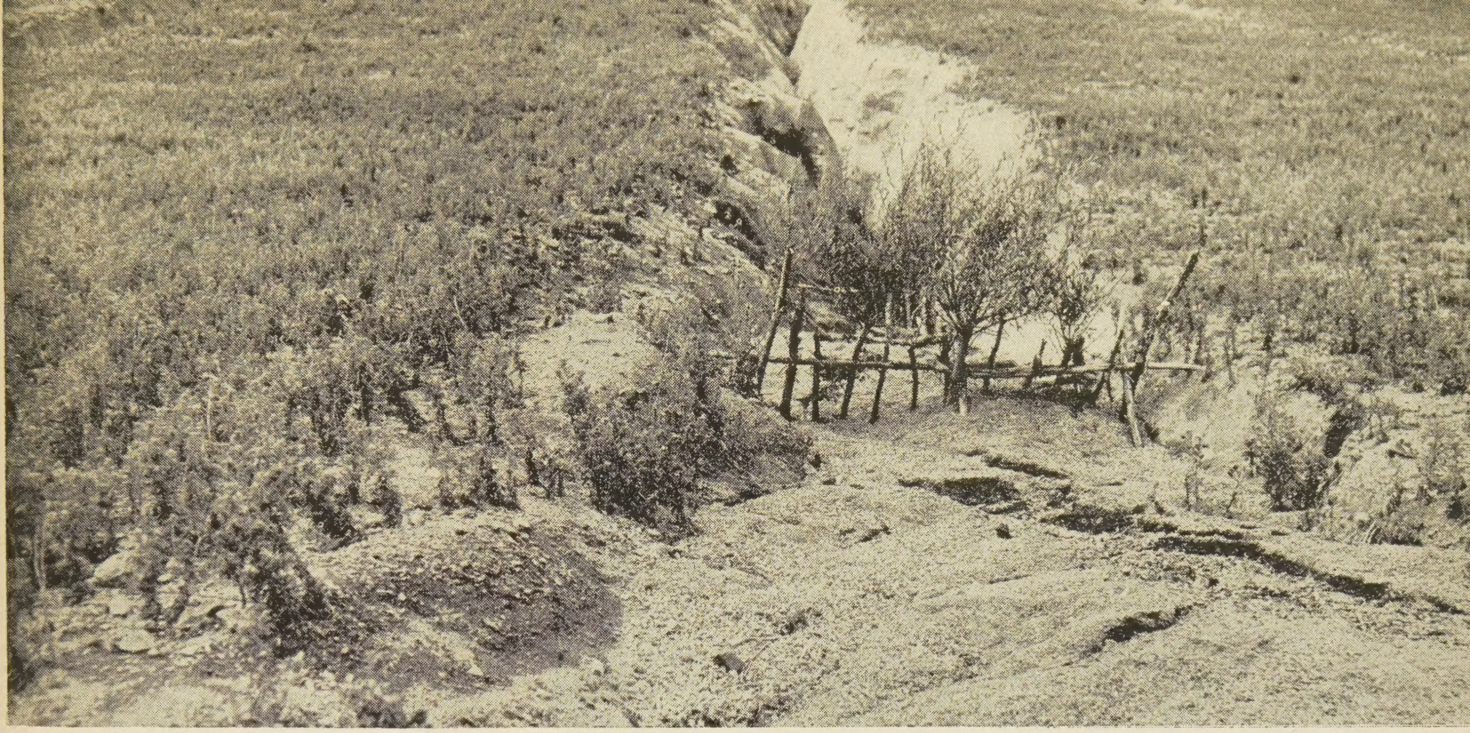
all of the Department of Agriculture

THE remarkable restorative effects of simple, practical measures of aerial oversowing, topdressing, spelling, and cattle grazing have been demonstrated on eroded mountain land at Mid-Dome in Southland. Before this property was taken over as a reserve by the Soil Conservation and Rivers Control Council it was subject to severe sheet, scree, and gully erosion; the shingle was pouring down the mountain and threatened the main road; in fact the rehabilitation of Mid-Dome appeared 10 years ago to be beyond human aid. This article describes measures taken to reclothe the mountain with erosion-resistant grasses and clovers, and the rabbit and fire control, planting of trees on eroding sites, and plugging of gullies with willow poles and netting dams which have been important supporting methods.





A frame debris dam of willow poles and netting arrests the movement of shingle in the early stages and helps to control gully erosion.

SO depleted and severely eroded was this 1,050-acre portion of the winter block of Fiery Creek Run, ranging from 1,000 to 4,826 ft in altitude, that in 1947 the owner was pleased to lease it for the conservation and experimental work necessary to rehabilitate it. At that time local runholders considered that its carrying capacity was 50 to 60 sheep.

The accelerated soil-erosion cycle was so advanced up to 3,000 ft elevation on this steep mountain side, which was exposed to the north-westerly winds, that the area looked desolate and hopeless. A wide band of bare scree that was being eroded enveloped the bulk of the mountain side, which was vertically slashed from top to bottom with recently eroded gullies and streams that disgorged great, bulging fans of rock over the lower slopes and flats.

The steeper slopes of the original streams and gullies were the most severely eroded, particularly on the sunny aspects, where the bare, eroding remnants of subsoil merged into bare rock or scree according to the nature of the underlying material.

← The Mid-Dome reserve is the area within the dotted line. Part of the Lumsden-Queenstown road is shown at extreme bottom right.

Above, a sparse cap of snowgrass tussocks was succumbing to frost lift and wind, sheet, and rill erosion. Below, fescue tussock closely cropped by rabbits survived in patches on the gentle slopes not already engulfed by shingle fans.

The area set aside for investigation was possibly one of the most difficult high country blocks in Southland, but was nevertheless representative of some 100,000 acres of high country which was approaching this condition of erosion.

In 1857 J. T. Thompson, an early surveyor, reported that the original tussock growth was so dense that he had difficulty in negotiating the slopes, and therefore lit a fire to clear the way; this fire got out of control, engulfing the Dome. This was one of the first hill country fires in Southland after the European settlement. With the introduction of rabbits in the 1860s, and overgrazing by stock and further burning, the vegetative cover became increasingly sparse, and it became difficult to maintain normal stock numbers. The general deterioration continued, exposing bare soil to the severe climate.

In less than a century the combined effects of burning and over-grazing by rabbits and sheep had almost ruined the land for pastoral purposes.

The progressive destruction of the native grasses exposed more and more bare soil to frost lift and wind erosion, while the increased run-off from accelerated sheet and gully erosion caused wholesale removal of detritus by streams to the flats below. Floodwaters from catchments in similar condition nearby were disgorging

Erosion has been Controlled

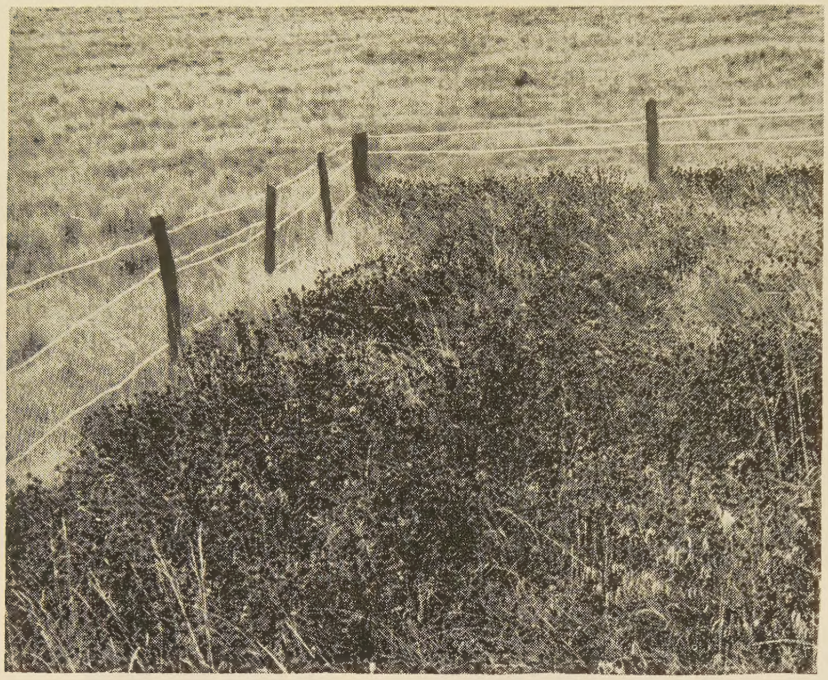
SOIL erosion on Mid-Dome, despite its extent and advanced condition, the steepness of the slopes, altitude, and exposure to high winds and hot sun, has been largely brought under control by revegetating the mountain side.

This was made possible by eliminating rabbits, oversowing and topdressing, spelling to promote reseeding, planting of trees on the most eroding sites (in gullies and high in the catchments), and recuperative grazing with cattle to control growth and spread seed.

As cattle were not available in sufficient numbers, sheep had to be used. The seasonal grazing has been built up from no cattle and 50 to 60 sheep on the whole area 13 years ago to 95 cattle and 250 sheep at present with only two-fifths of the whole area being used for grazing.

The real harvest has been establishment of confidence in a conservation programme for high country in this area that has already been undertaken by farmers and used in rehabilitating Run 352B in Eyre Creek Catchment.

Possibly even more important, the menace of debris-laden flood waters to stream channels and lower flood plains of the river has been greatly reduced.



In the rabbit-proof enclosures the response to oversowing with clovers and grasses and fertilising with superphosphate indicated the possibilities of large-scale treatment.

debris into tributaries of the aggrading (depositing of shingle in river bed) Oreti and Mataura Rivers to swell the flooding problems of down river farmlands.

CONSERVATION PROGRAMME

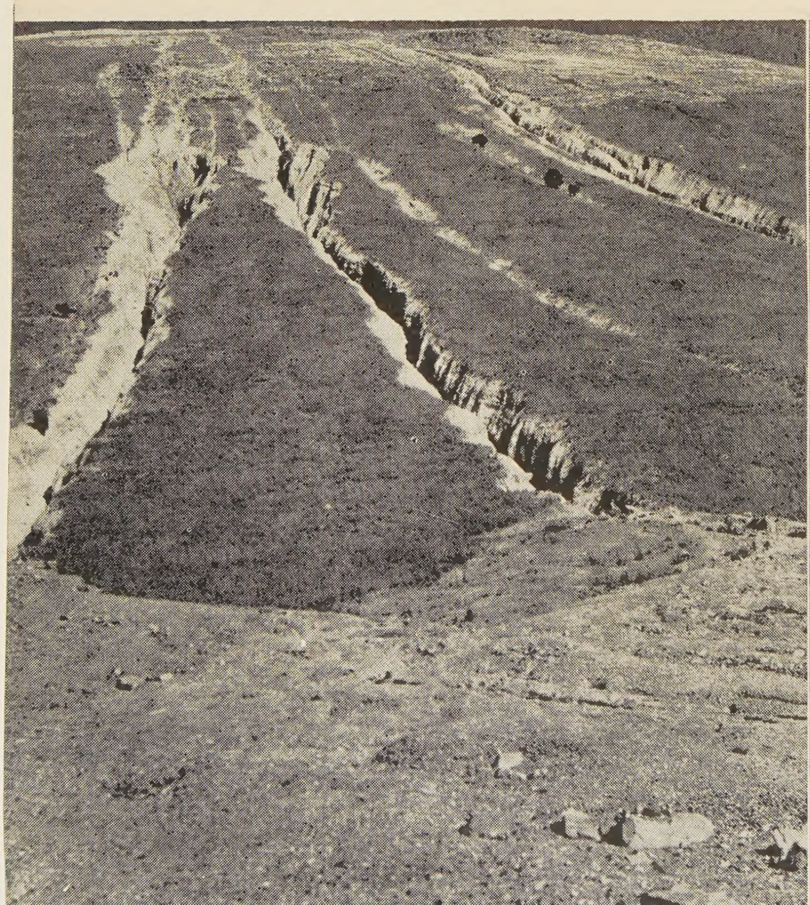
First Phase

The first phase of the programme sought removal of the cumulative effects of burning and overgrazing by sheep and rabbits.

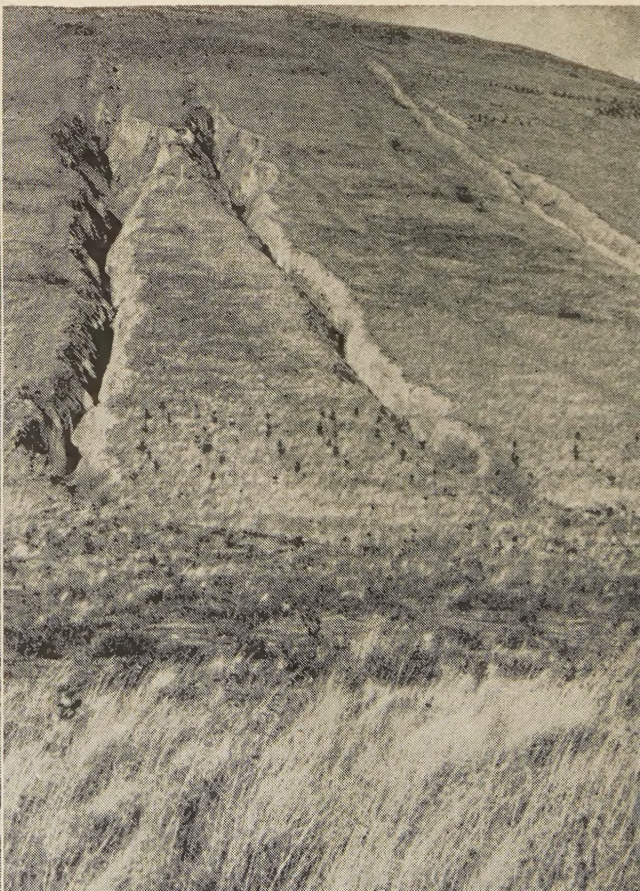
Wing fences were erected high enough up on the mountain to exclude neighbouring stock so that spelling would be complete, and burning was safeguarded against. An experienced rabbiter was employed in a vigorous rabbit-killing campaign, but this was only partially successful until the whole district came under the control of the local Rabbit Board that was subsequently established.

To determine whether remnants of the native grasses and patches of native bush in shady gullies could be regenerated under the eroded conditions to achieve the original stability provided by vigorous tussock shrubs and bush, observational plots were established in representative locations, and their progress was recorded photographically.

▼ Before treatment.



With the improved cover resulting from treatment ▼ erosion in the gullies is less and the fan is stabilised by grasses and clovers.



In 1949 the first attempt was made to establish improved grass species on depleted lower slopes. Observational plots were sown with grasses and clovers, including cocksfoot, Chewings fescue, browntop, Yorkshire fog, tall oat grass, crested wheat grass, *Danthonia pilosa*, white clover, subterranean clover, broad red clover, Montgomery red clover, and sweet clover. The most striking feature of the investigation was the effect of rabbit fencing as shown by the growth grasses and clovers made when protected from rabbit browsing. Fertiliser trials incorporated in this investigation indicated that clovers responded to superphosphate.

Trial seedings, with and without fertiliser, were made in rabbit-proof enclosures, and several trial plantings of hardy, aggressive exotic trees were made to determine the capacity of grasses and trees to revegetate the eroded areas.

The most striking feature was the marked response to superphosphate, particularly that of red clover on the middle and lower slopes (see illustration of fenced plot on the opposite page). The grass response appeared to be further enhanced by the associated clovers.

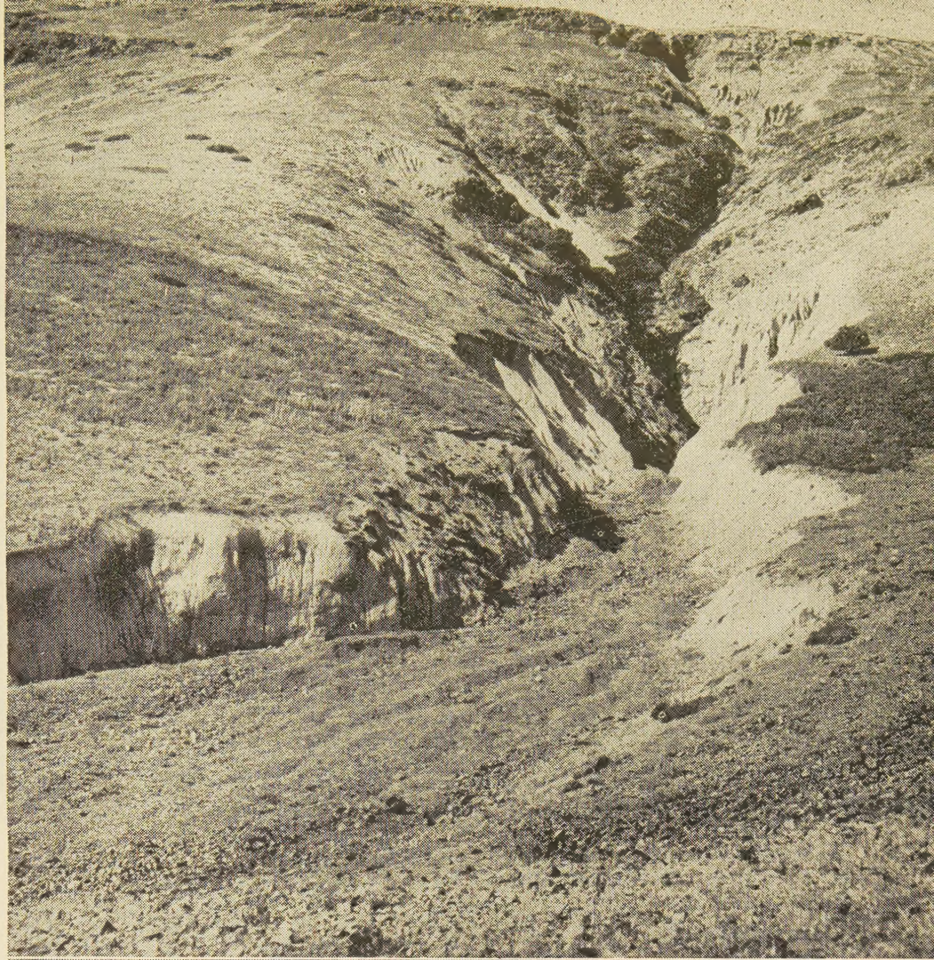
On the higher and steeper areas greater frost lift and soil movement made grass establishment more difficult, particularly in the remnant of snowgrass.

Existing native grasses grew vigorously and seeded under spelling, but did not colonise the bare ground.

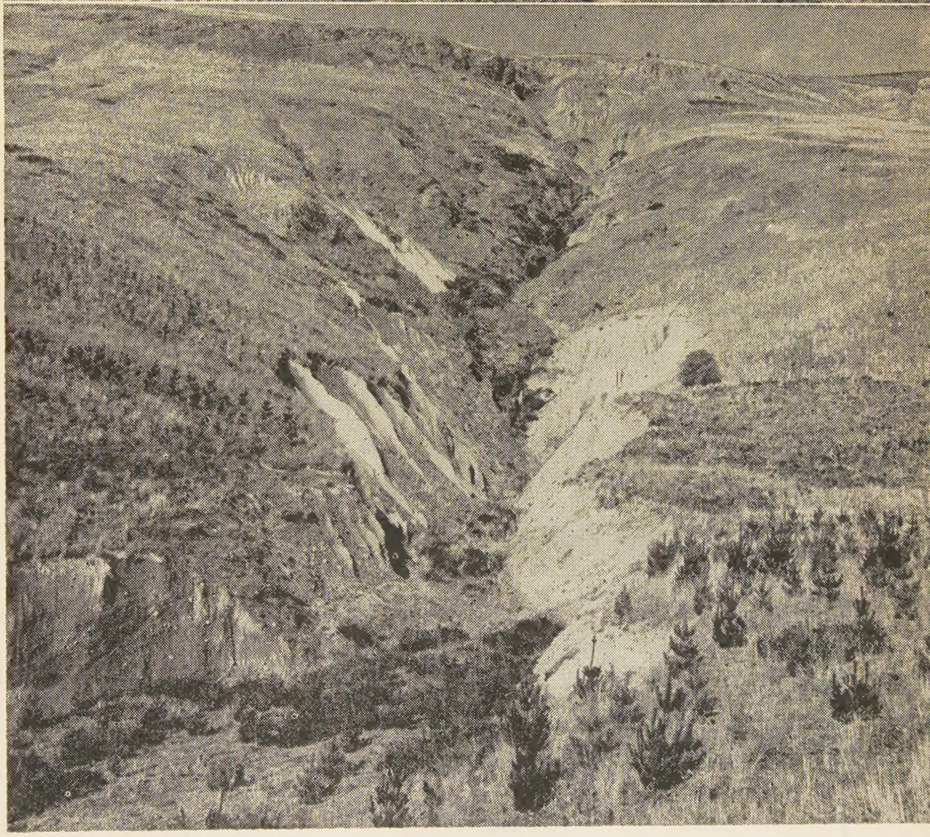
Pinus murrayana, however, under difficult conditions on the heights established and grew vigorously, particularly where protected by sparse remnants of snowgrass. Various species were planted from 1,000 to 4,400 ft. Practically all the early tree planting on the lower slopes was a failure owing to concentrated rabbit browsing.

Willow and poplar poles planted in eroding gullies established well wherever there was sufficient moisture, particularly on the middle and lower slopes and in the streams of shingle.

The loose stones of the virtually bare scree slopes provided an ideal protective pavement or mulch on the remnants of soil and subsoil in which cocksfoot, red clover, white clover, tall oat grass, and other pasture plants established, flourished, and reseeded vigorously under complete spelling.



Before treatment. →



After treatment: Grassing of → the upper catchment has stopped gullying and shingle movement and allowed grass and trees to stabilise shingle in the foreground.

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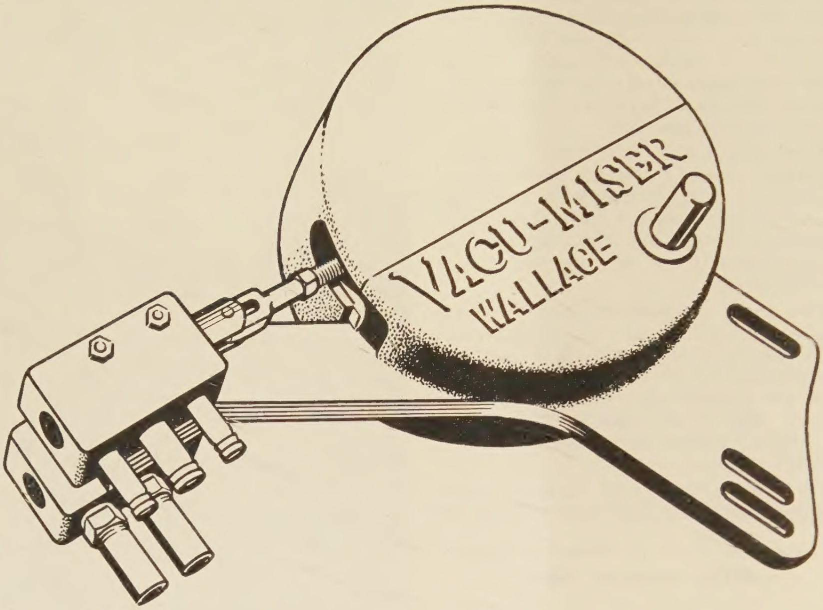

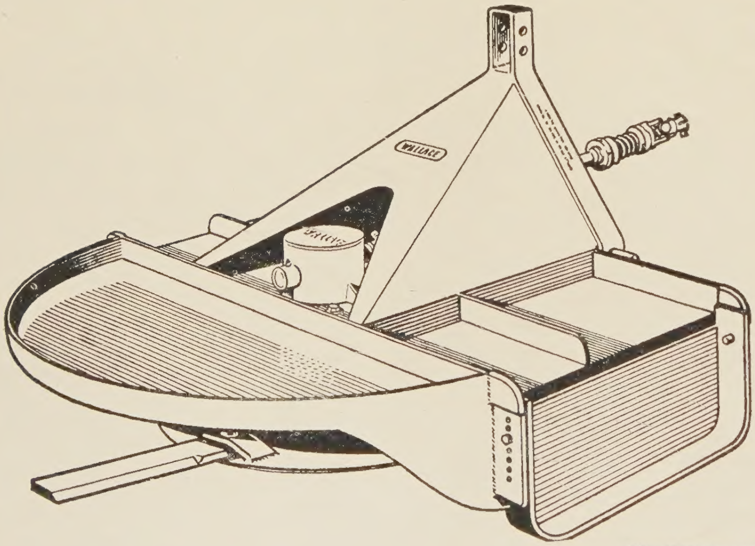

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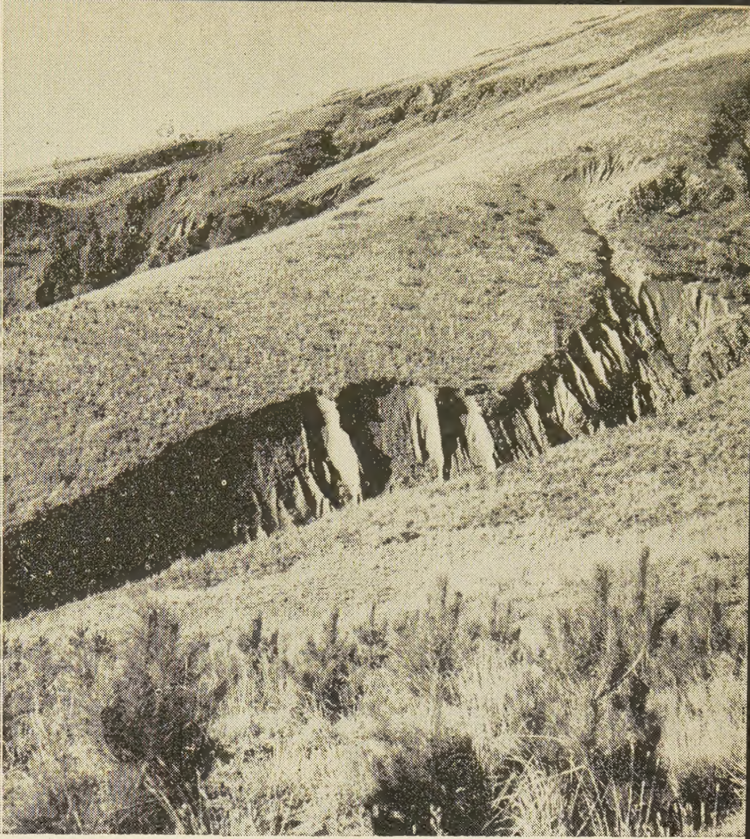
Before treatment.



Planted trees and oversown grasses revegetate the higher slopes effectively.

These experiences provided a basis on which to formulate a conservation programme and appropriate management for the whole area, using grasses and clovers over the major portion and trees where maximum protection was needed on eroding steep upper catchments, in gullies, or in streams.

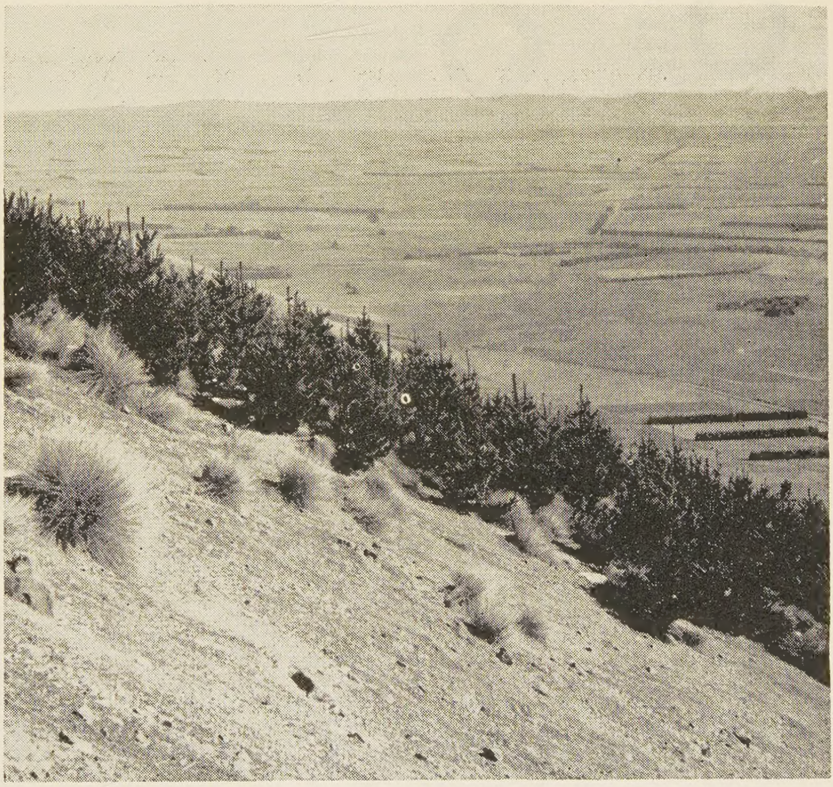
In 1950 the first attempt was made to introduce grasses and clovers on a field scale when some 90 acres were oversown. While the strike was relatively good, the plants did not survive the constant rabbit browsing.

The first field scale success came in 1952, when a steep slope was oversown with cocksfoot and inoculated white clover, plus some tall oat grass, browntop, and ryegrass. The area established readily and appeared to be less browsed by rabbits.

Second Phase

The second phase of the conservation programme consisted essentially of:

1. Intensifying rabbit elimination with the assistance of the Eyre Rabbit Board, extending fencing to provide rigid control of grazing, and control of fire.
2. Aerial oversowing of the wide band of denuded and eroded land between the snowgrass and the lower slopes, the more responsive lower slopes, and the shingle fans with suitable mixtures of grasses and clovers.



Pinus murrayana has established successfully at 3,000 ft.

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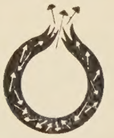
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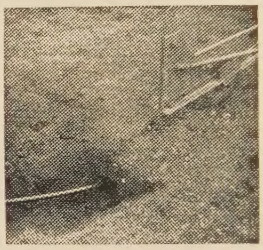

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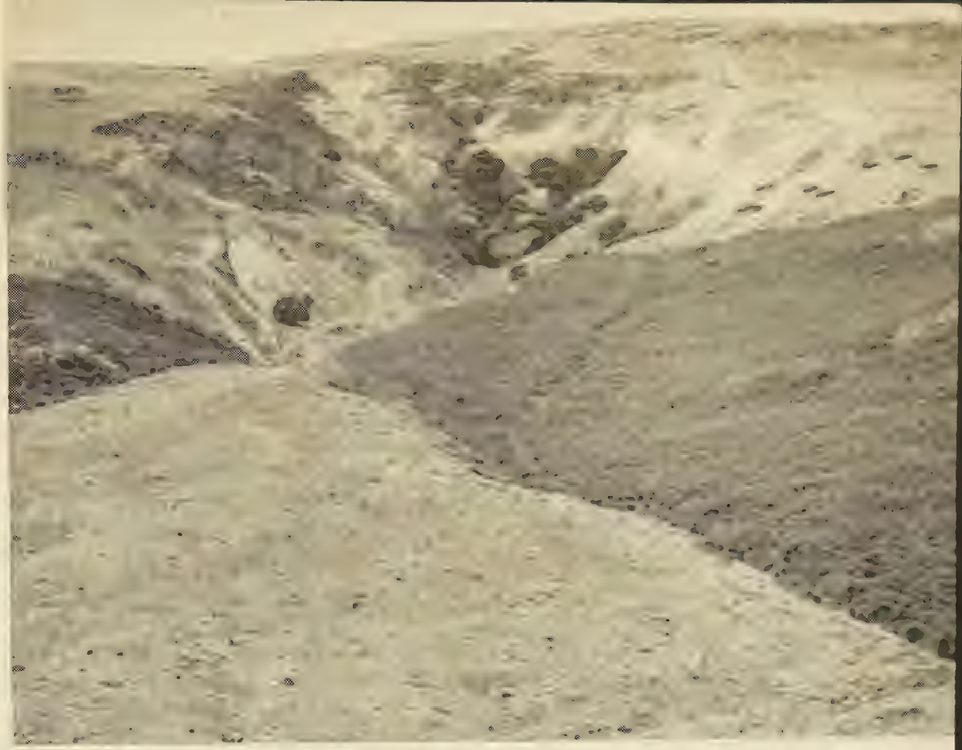
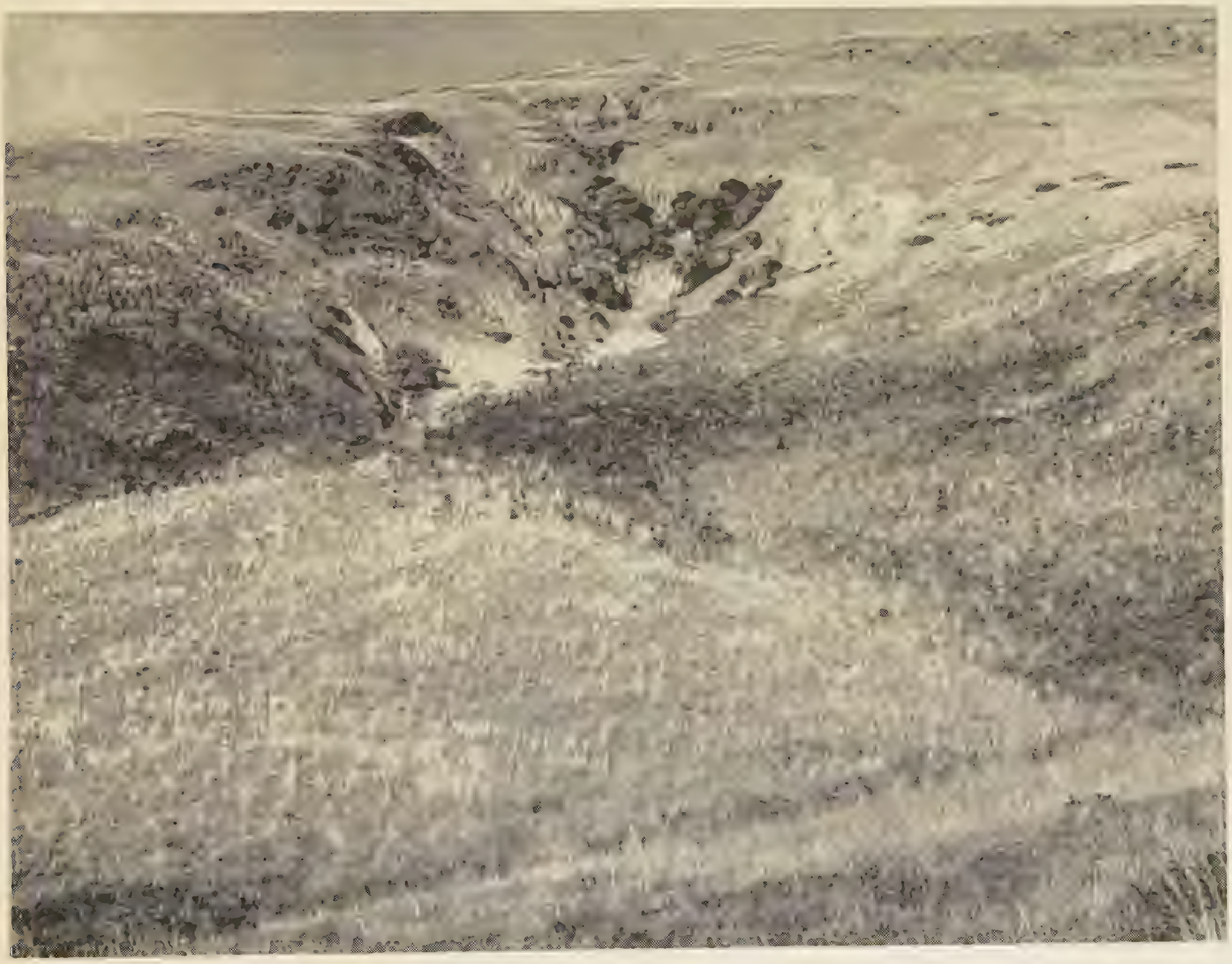
3. Planting of blocks of *P. murrayana* high on the eroding slopes along the lower edges of the snowgrass and in the upper catchment of the worst eroding stream.
4. Planting of willows and poplars in eroding gullies and creek beds, and the construction of live willow debris dams; holding wire netting in place to trap debris and make effective drop structures.
5. Moderate use of cattle to graze surplus growth after seed setting to spread seed and reduce the fire hazard.

In 1955 the first large scale oversowing and topdressing was carried out on the lower portion of the reserve. This included cocksfoot,



Before treatment. →



↓ Striking results achieved from planting the eroding shingle fan and slopes above it with grasses and clovers. Red clover is prominent among the grass in the foreground.

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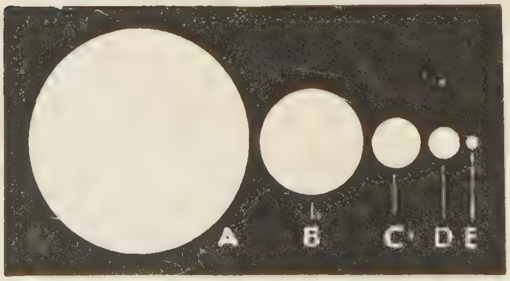

A—Particle of typical domestic flour.

B—Particle of high quality face powder.

C—Size of a Red Blood cell in the human body.

D and E—Typical particles of TARTAN FENODREN Phenothiazine.

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white clover, and Montgomery red clover, plus 1½ cwt of superphosphate. Worth-while control of rabbits was not achieved until Rabbit Boards introduced extensive 1080 poisoning in 1956.

RESPONSES TO MANAGEMENT

As expected, recovery was slow at first, but real progress was made when rabbits were virtually eliminated. The cumulative effect of spelling, oversowing, natural reseeding of grasses and clovers, and topdressing was so marked that moderate grazing was required on the lower area once the rabbit was controlled.

Response of the wide denuded band of scree and bare earth to oversowing and topdressing was quite remarkable. The establishment, stooling out, and reseeding of cocksfoot were outstanding, while red and white clover established, reseeded, and spread unexpectedly well. Tall oat grass proved the most aggressive grass; it rapidly provides a dense, protective cover that is not grazed readily by stock. Clovers and several other grasses also established and spread well.

On the lower slopes and fans the response to oversowing and topdressing was greater, though not so spectacular, and a vigorous mixed community of cocksfoot, red clover, white clover, native silver and fescue tussock, danthonia, and bluegrass provided a complete ground cover and considerable grazing.

The high level block plantings of *Pinus murrayana* not only established successfully, but made good growth (1 ft per year), and are now producing cones and seed in the high upper catchments where snowgrass recovers slowly and has so far failed to colonise bare ground by reseeding.

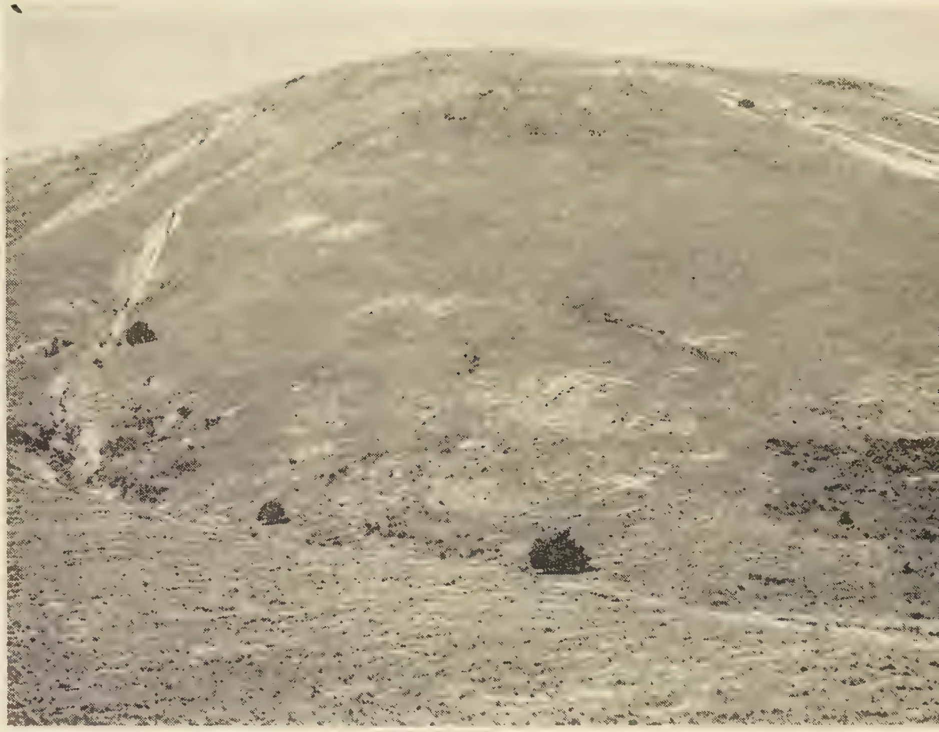
The accumulation of litter may gradually provide conditions favouring establishment from seed, as it does in other situations at similar altitude.

Gully control plantings of willows and poplars in the sides of the lower deep cuts have rooted effectively to stabilise the sides and develop an erosion-resistant mattress of roots in the gully floor.

The "A"-frame willow-pole netting dams constructed at 12 to 30 ft intervals, according to grade, up the gullies have impounded debris that is now bound together by root growth and provides a series of drop structures to rob the run-off water of its eroding power.

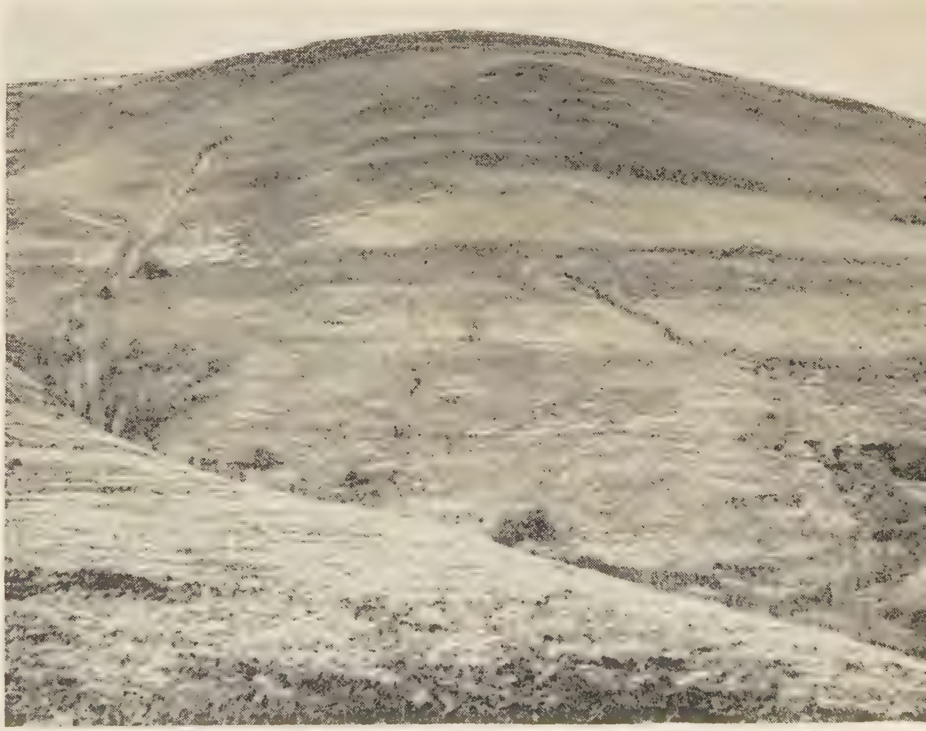
An equally prominent feature of gully control is, of course, the reclothing of the upper catchments of gullies with increasingly strong protective cover that reduces the rate of run-off and the amount of debris carried.

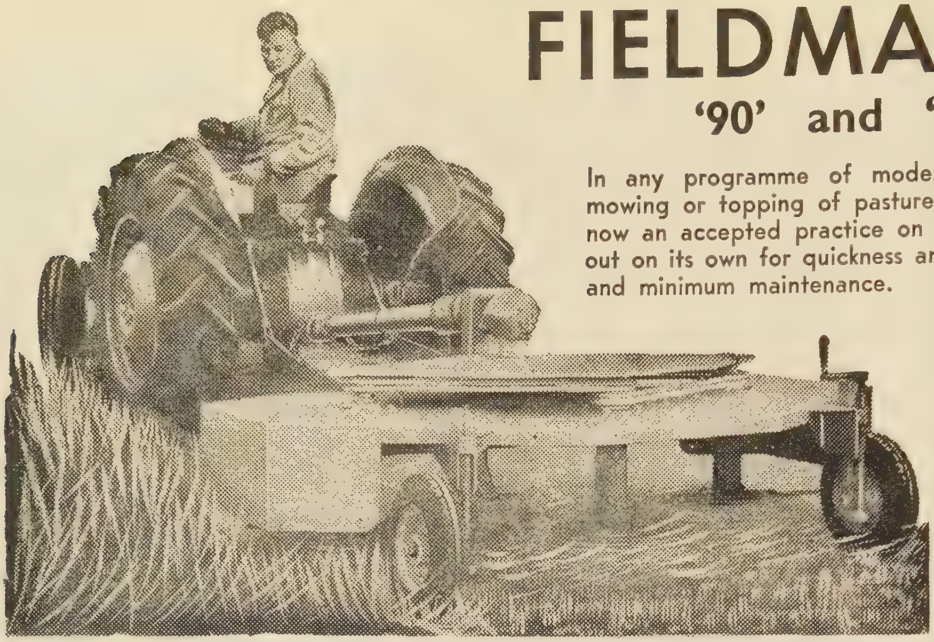
The growth and effects of large deeply planted willow posts in the form of live debris structures in the



Before treatment.

▼ After treatment cocksfoot, red clover, and tall oat grass are prominent on the once-denuded centre slope at about 2,500 ft.





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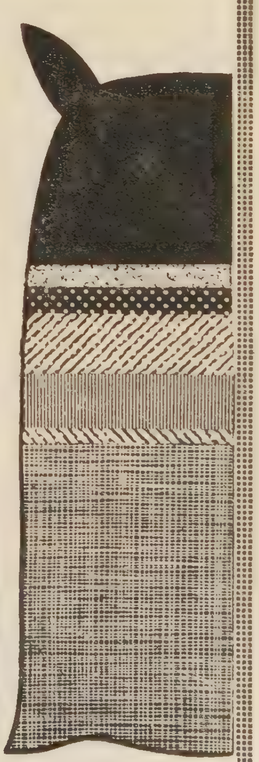
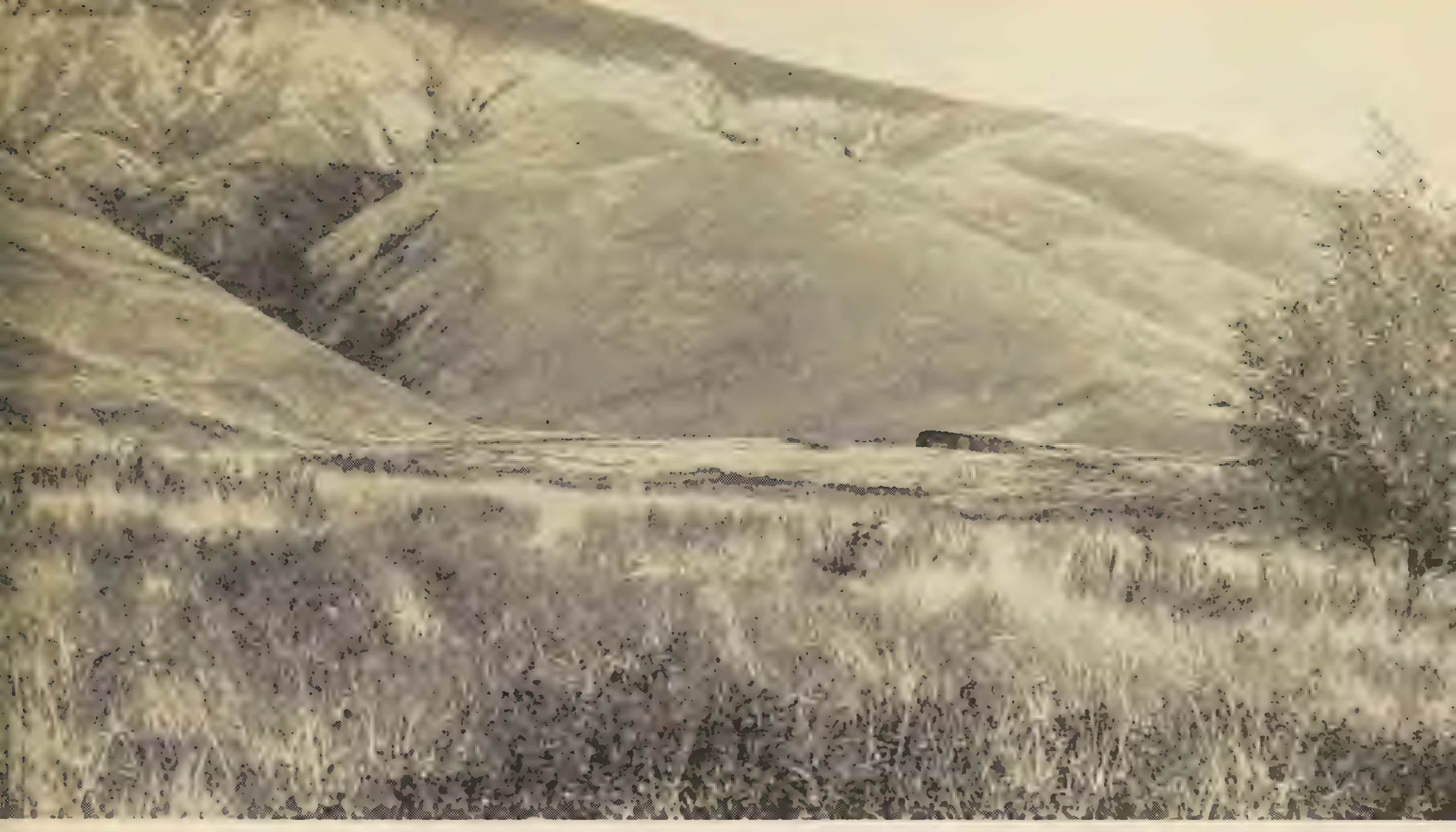
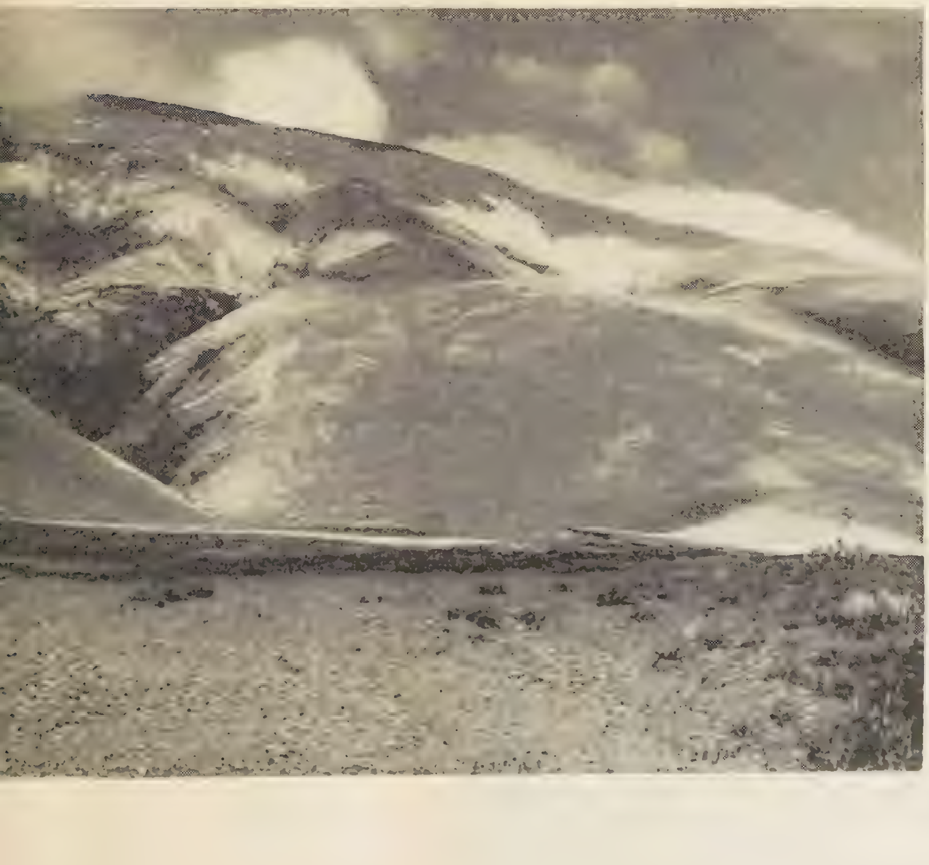




The cover in the foreground and on the slopes in the middle distance is a striking contrast with the still eroding slopes below the summit snowgrass. The treated area is at about 1,200 ft.

▼ The same area before treatment.



shingle-laden lower reaches of the main stream indicate how valuable further plantings could be in controlling the stream and "fixing" the heaps of shingle.

When regeneration of native species and revegetation by exotic species reached a certain stage, control and use of surplus growth became important in the recovery programme. Experience has proved that moderate cattle grazing provides the best convalescent treatment. Grasses and clovers were grazed during autumn and winter after seeding, and spelled during spring growth and summer seeding.

In 1957 the lower area of some 400 acres of improved country was fenced off from the more erodible area in an endeavour to graze the improved cover. In 1958 the first concentrated grazing of the lower portion of the reserve gave 26,600 sheep days; 1959 gave 115,250 sheep days and 9,036 cattle days; and 1960 appears to be as good as 1959.

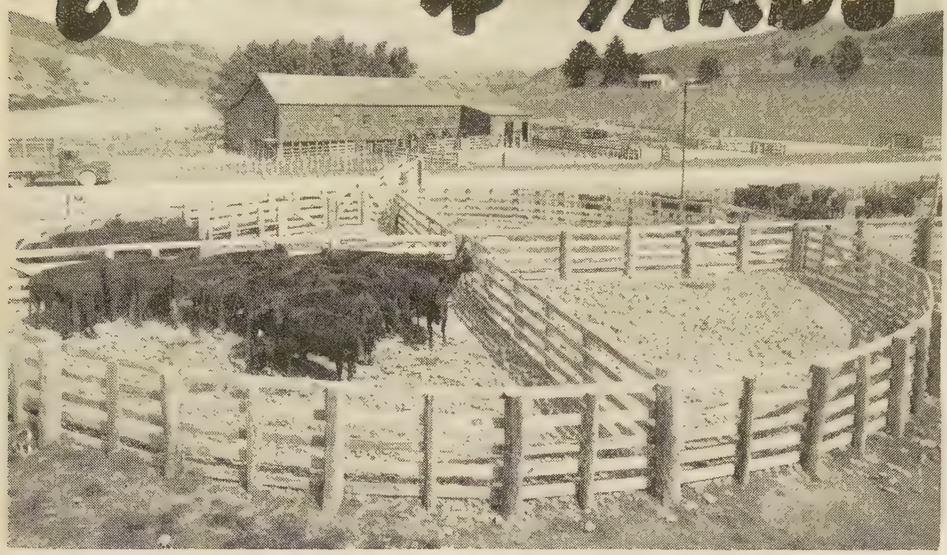
Once the rabbit is controlled, there appears to be no difficulty in establishing cocksfoot and clovers with superphosphate.

The Soil Conservation and Rivers Control Council organised this project and it has been carried out by an advisory committee comprising the Department's District Soil Conservator, the local Soil Conservator, and representatives of the Southland Catchment Board, the Department of Lands and Survey, the Forest Service, and the Ministry of Works.

CIRCULAR CATTLE YARDS

By E. B. SMYTHE,
Livestock Instructor,
Department of Agriculture,
Gisborne

IN the circular designed cattle yard, cattle run better than in the conventional type of rectangular yard and "draw" round the curved outside fence into the crush-pen and race, instead of milling round as they do in the square corners of a rectangular holding yard or triangular crush-pen, which have for many years been a weakness in cattle yard construction.



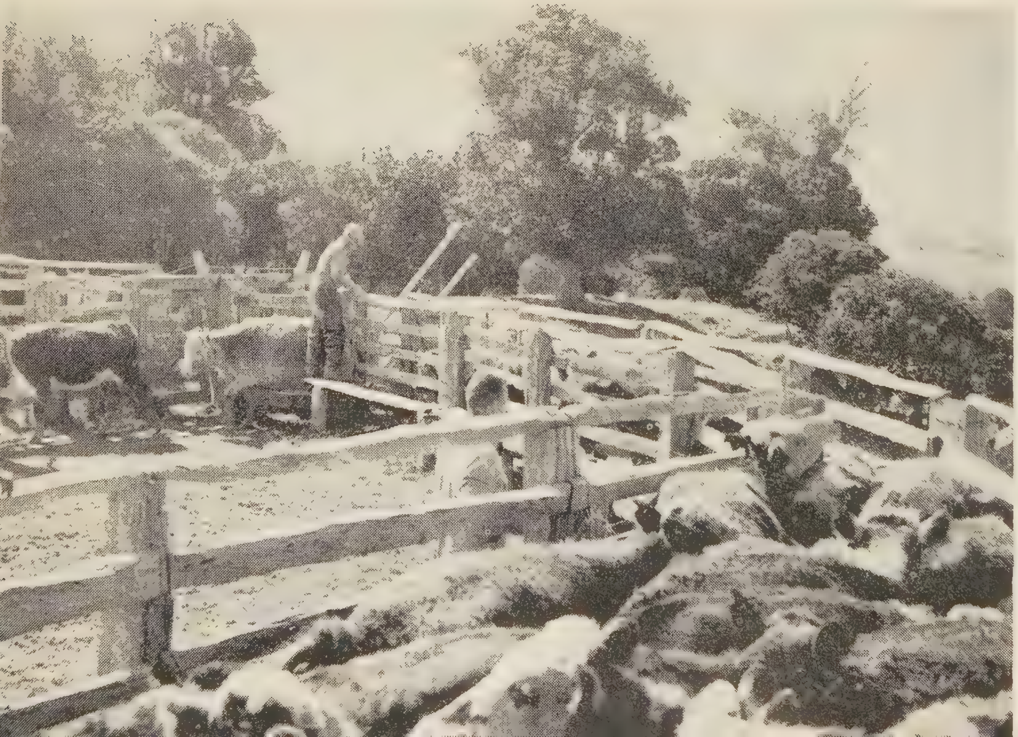
Yards on Tikitiki Station at Tikitiki, East Coast. The close rails on the loading ramp enable loading of sheep and lambs as well as cattle.

- Well planned stock yards enable speedy, safe handling of stock without bruising or excitement
- Examinations and vaccinations are simplified
- A round pen makes animals move willingly

WITH the curved race the cattle cannot see the bail until they are right up to it and if they try to back out, they bump into the outside fence and go forward again. The curved race, being much longer than the old type of straight race, has also proved considerably more convenient for loading cattle and for veterinary work such as vaccinations, pregnancy diagnosis, blood testing, and operations.

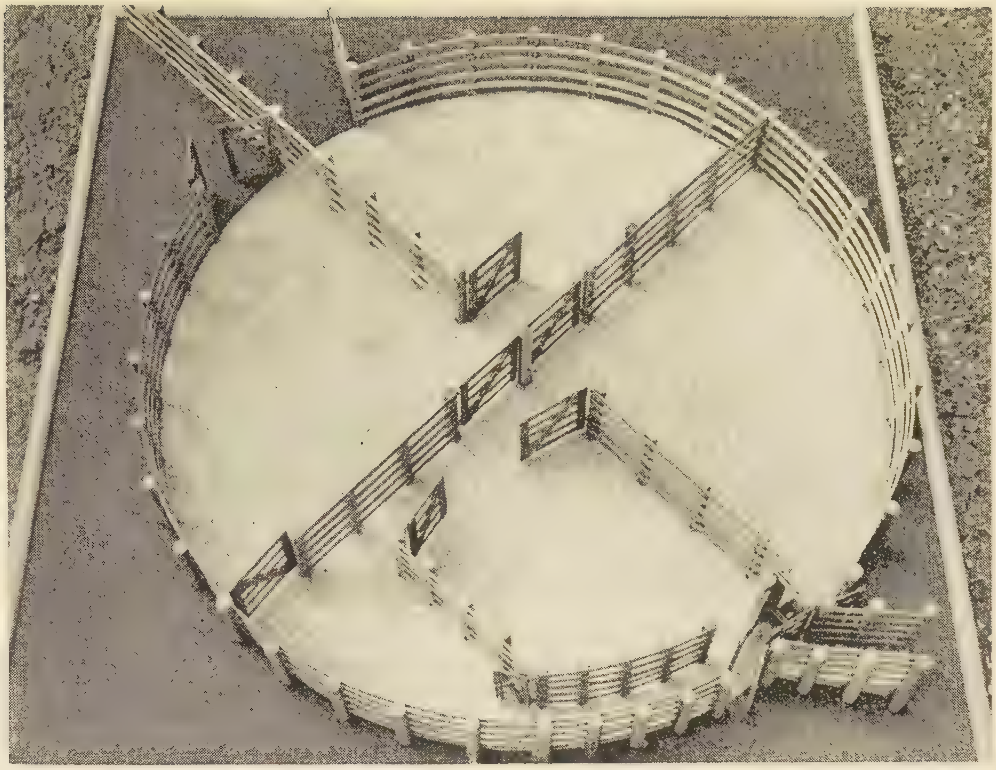
One of the main advantages of the circular design of cattle yard is that all essential facilities are available in the one quarter, and therefore with 39 strainers plus the necessary bail, gates, and rails it is possible to erect a holding yard, crush yard, race, bail, and loading ramp.

This quarter can be added to later to make a half-circular yard or complete circular yard or built on to existing holding yards with no great difficulty.



← Yards at Wensleydale Station, Whangara, Gisborne, were built from strainers and rails cut on the property. Note the platform which is used to inspect the cattle and is also most useful for the operator during vaccination. The gates near the bail are being used to draft off a line of cattle as they run through the race, in the same way as sheep are drafted.

The poor design and → layout of conventional older yards should be compared with advantages of circular yards as in the model shown. Note the long, curved race, drafting gate near bail, loading ramp on to road, and central gates to enable cattle to be moved from any yard to any other. Crush-pen and race may be easily drained.



Selection of Site

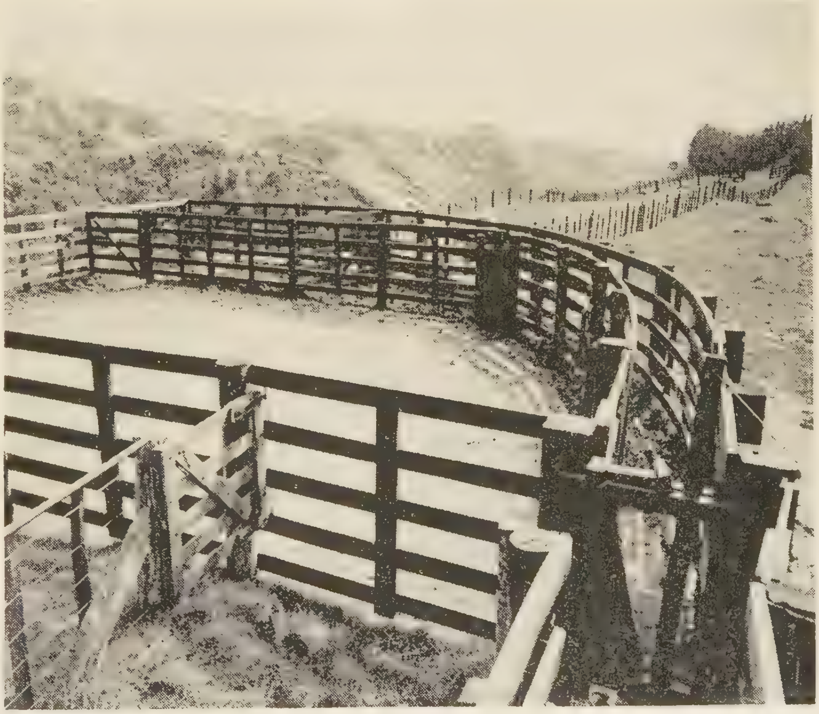
Selection of a good site for new cattle yards is most important. They should be built where cattle can easily be mustered into them from all parts of the property and with an all-weather road so that they can be transported by lorry whenever desired.

Drainage must be considered and here the circular design has proved more practical than the old rectangular design with the short central race, which produces a sea of mud in the centre of the yard which is almost impossible to drain.

Muddy yards increase the risk of infection, particularly during operations and inoculations such as for the control of blackleg, contagious abortion, or leptospirosis.

Note

Bulletin No. 380, "Cattle Yards", obtainable at all offices of the Department of Agriculture, provides useful information regarding the measurements and materials required for many different types of bails, gates, and catches, and could be used in conjunction with this article.



An example of good design and layout of cattle yards on Waingaromia Station, Tolaga Bay. The rails are treated keruing with silver pine strainers.

GREEN CELERY IS SUPPLANTING SELF-BLANCHING TYPES

By A. B. WEBSTER,
Scientific Officer, Department of Agriculture Horticultural Research Station, Levin

CELERY is a very popular salad vegetable in the United States of America, where the only type grown extensively is the green celery, which is a development from the self-blanching type and is so much superior to it that no self-blanching celery is now grown in the U.S.A. and only very little in Australia.

GREEN AND SELF-BLANCHING CELERY COMPARED

Criteria	Green	Self-blanching
Yield per acre	Very heavy	Heavy
Height of plant	Tall to very tall	Tall
Diameter of plant	Large	Medium
Bolting	Very little or none	A little
Heart rot	A little	A little
Colour of stalk	Pale green	Creamy white
Colour of leaves	Green	Yellowy green
Stringiness of stalk	None	A little
Crispness	Very good	Good
Flavour	Very good	Good
Market appearance	Very good	Very good

GREEN celery forms a large, vigorous head. No earthing up or other expensive cultural operations are required. It is fairly resistant to many of the troubles such as bolting, rots, leaf-spot, and other diseases which beset celery. It makes a good market pack which stores well in transit, even over long distances. The fresh, crisp green stalks have a very fine aromatic flavour.

Superior Flavour and Texture

A variety trial was conducted at the Horticultural Research Station, Levin, last summer to find out which were the best varieties of celery and to compare the green with self-blanching types. When grown under identical conditions the green type gave heavier crops of larger, firmer, crisper heads than the self-blanching types. Diseases were less troublesome on the green types. Everyone who tasted the two types agreed that the flavour and texture of the green type were much superior to those of the self-blanching.

The Utah varieties as a group did best in last season's trial, and of these Tall Utah 52-70 was the best. The Pascal varieties and the Slowbolting Green varieties tried were also good, but not quite up to the standard of the Utah group.

Two trials featuring green celery are in progress at Levin. One is a variety trial in which the best varieties from last season are being compared with other newer varieties. A self-blanching variety is included for comparison.

The second trial deals with the effects of time of sowing, system of planting, and gibberellic acid on green celery. This experiment, containing 15,000 plants, should give very useful information on the performance of one variety at different times of the year and will show whether it grows as well in wide beds as in double rows. Gibberellic acid lengthens the celery stalk, but its effect varies with the time of year.

Making Qualities Better Known

To make the qualities of green celery better known heads from this trial will be sent regularly to the markets of a small city to try to foster an appreciation of its highly desirable characters and to create a demand for it which should encourage growers to give it more attention.

Most previous attempts to introduce this new type of celery failed at the marketing stage. The New Zealand housewife is accustomed to buying a rather narrow stick of celery with creamy white stalks and yellow-green leaves. When confronted with a robust stick with green stalks and green leaves her immediate reaction is that the green celery is coarse and would make tough eating. Snapping a stalk and eating a little would show that this is not so.

Grown the Same as Self-blanching Celery

Green celery should be grown the same way as self-blanching celery. Dig or plough in a good dressing of compost or green crop the previous winter and then lime to bring the pH up to 6.2. Apply a base fertiliser of 8 parts of superphosphate and 3 parts of sulphate of ammonia, and perhaps 1 part of sulphate of potash if needed, at the rate of 4 oz per square yard before planting.

Plants are raised in a glasshouse or frame and pricked out in boxes of good potting compost, 2 in. being allowed each way per plant. The plants must be protected from frost at this stage and must never dry out.

After the plants have been watered in allow them to become established and then water them heavily once a week and side dress them with a mixture of 1 part of sulphate of potash to 3 parts of dried blood at the rate of 2 oz per square yard before watering. During wet, humid weather spray with a copper fungicide against leaf spot.

A suitable planting scheme is to have two rows 6 in. apart every 3 ft. The plants are 12 in. apart in the row and they are staggered.

Good Responses to Sulphur in S. Canterbury

By C. C. McLEOD,
Farm Advisory Officer,
Department of Agriculture,
Timaru

Highly sulphur responsive tussock hill country, Pukaki, showing white and alsike clover strip drilled through a native tussock association with 1 cwt of superphosphate fortified with sulphur.

SULPHUR deficiency occurs widely in the South Island and several articles already published in the "Journal" have explained where the deficiency exists or may exist and recommended rates and forms of sulphur which give the best responses under various conditions. This article is the first to deal comprehensively with investigations into sulphur deficiency over a large part of South Canterbury. To date trials there have shown that:

- On unimproved tussock hill country the emphasis should be on increased dressings of sulphur rather than phosphate.
- On unimproved browntop and fescue foothill country high rates of both sulphur and phosphate and some molybdenum are essential for good pasture growth.
- On the improved lower country other than the clay downs sulphur responses are similar to those on the foothill country.
- On the clay downs and very highly improved country of the freer-draining soils sulphur responses are not clearly defined.
- For rape, swede, white-fleshed turnip, chou moellier, and kale crops phosphate is more important than sulphur.
- For wheat crops inclusion of sulphur at sowing is not essential for high yields. A manure containing both sulphur and phosphate (superphosphate) is preferable for drilling with barley.

EXCEPT for the cereal trials, the sulphur investigations reviewed in this article took place in that area of South Canterbury defined by the Otaio River in the south, the Rangitata River in the north, and the Mackenzie Country in the west (see map on page 227). This district includes tussock areas of the hill and high country, browntop foothills, rolling downs country, and coastal plains. The plains vary from light stony soils to very heavy silt loams.

The two most important materials used in South Canterbury are lime and superphosphate. Rates of application of the two manures are usually 1 to 2 tons and 1 to 2 cwt per acre respectively with the frequency of application varying widely from farm to farm. Apart from nitrogenous manures topdressed in spring for grass seed production, superphosphate is used to the exclusion of almost all other fertilisers for the topdressing of pastures and the sowing of all crops. Additives, such as sulphate of ammonia, DDT, or hormone weedkiller may be included, but superphosphate remains the basic manure.

In recent years, however, keen interest has been aroused in trace elements and many people interested in agriculture are concerned with the possibility that as a result of concentration on the use of superphosphate and lime other elements important in pasture production and stock health have been overlooked.

To find out if trace element deficiencies were limiting pasture production 20 trace element trials were laid down on pasture in 1954 in the area of South Canterbury defined earlier. These trials were established in numerous localities and on a wide range of soil types. Treatments included the elements copper, zinc, vanadium, boron, magnesium, manganese, molybdenum, and sulphur. Additional plots in all trials were topdressed with either 2 cwt of superphosphate or 1 cwt of double superphosphate per acre.

The following year, though several trials showed good responses to molybdenum application, the most outstanding response was from the application of 28 lb of sulphur per acre. This element improved the colour and greatly increased the density and vigour of the clovers. Clover responses were also frequently seen in the 2 cwt of superphosphate plots, but usually no response was obtained from the application of 1 cwt of double superphosphate. This was consistent with a response to sulphur alone, as superphosphate contains both sulphur and phosphate, while double superphosphate contains phosphate but no sulphur.

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These experiments suggested that pasture growth responses observed after superphosphate topdressing could be due mainly to the sulphur in that fertiliser rather than to the phosphate. This finding was also consistent with soil testing results. Frequently growth increases were seen after topdressing of pasture with superphosphate, even though the soil test taken before topdressing showed a high phosphate figure.

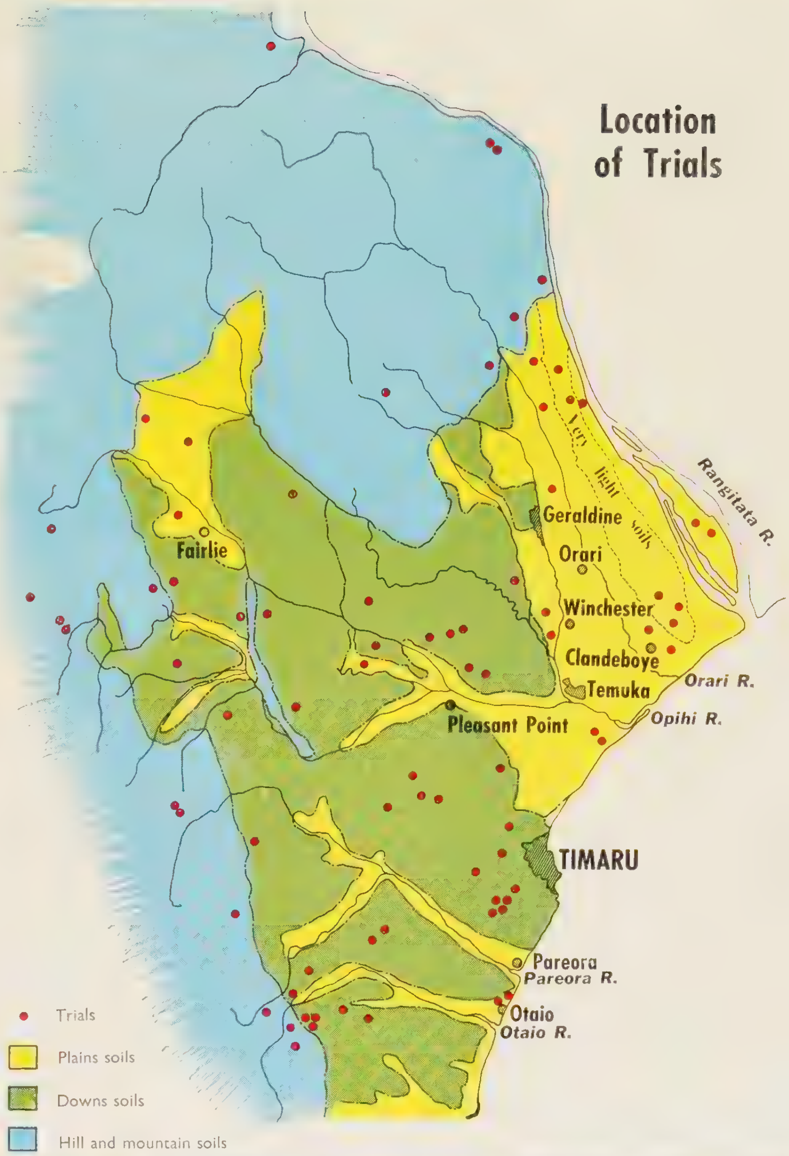
The next step was to find the relative importance of phosphate and sulphur in stimulating pasture growth and how much of each should be combined for best pasture topdressing results. A hundredweight of 44/46 superphosphate contains about 12 lb of sulphur, but as the trials showed particularly good responses to 28 lb of sulphur per acre and little response to phosphate alone, it appeared likely that to obtain maximum pasture production the quantity of sulphur per acre should be increased without increasing the amount of phosphate applied.

To obtain this information 16 rates-of-phosphate x rates-of-sulphur trials were laid down on as wide a range of soil types as possible. The rates were: nil, 7 lb, 14 lb. and 56 lb of sulphur and nil, 14 lb, 28 lb, 56 lb, and 112 lb of double superphosphate. These were topdressed both singly and in pairs; for example, 56 lb of sulphur alone, 56 lb of sulphur plus 14 lb of double superphosphate, 56 lb of sulphur plus 28 lb of double superphosphate, etc.

Trials on Pasture

Results from these sulphur topdressing trials on pasture were as follows:

1 On unimproved tussock hill country (for example, soils of the Omarama and Hurunui series) sulphur application gave outstandingly large and consistent responses. These trials were oversown with 2 lb of Mont-



Location of Trials
Rangitata R.
Very light soils
Geraldine
Orari
Fairlie
Winchester
Clandeboye
Temuka
Orari R.
Opihi R.
Pleasant Point
TIMARU
Pareora
Pareora R.
Otaio
Otaio R.
● Trials
🟨 Plains soils
🟩 Downs soils
🟦 Hill and mountain soils

Typical South Canterbury tussock hill country which responds extremely well to sulphur application.

Excellent hill country production from Montgomery red, white, and alsike clovers. This tussock area was oversown with 1 lb of Montgomery red, 1 lb of white, and 1 lb of alsike clovers and topdressed with 1 cwt of superphosphate fortified with sulphur two years previously.

Trial sward before topdressing and oversowing. Tussock association with no clovers. Very low production.

Half hundredweight of double superphosphate treatment, showing a good take of clovers which, however, remain yellow, unthrifty, and low producing owing to sulphur deficiency.

gomery red clover and 2 lb of white clover per acre.

In every trial on this class of country 56 lb of sulphur per acre gave an outstanding response. Clover in these plots was always a dark green, vigorous mat, whereas in the phosphate treatments it was yellow and unthrifty. In several tussock hill country trials additional responses were obtained from applying phosphate as well as sulphur. However, where this occurred 28 lb of double superphosphate was found to correct the phosphate deficiency; more phosphate did not give a detectable response.

Where phosphate deficiency did exist, clover in the plots receiving double superphosphate alone (at all rates of application) was thin, yellow, and had very little vigour. This was because sulphur deficiency had not been corrected and still limited clover growth. These plots were superior to the oversown no-manure plots because in the latter, owing to both phosphate and sulphur deficiencies, clovers usually did not establish at all. However, compared with the sulphur treatments, all plants in plots receiving phosphate alone were thin, yellow, and unproductive.

The tussock hill country trials can therefore be summarised by saying that where phosphate deficiency **did not** exist 56 lb of sulphur per acre gave the best results, but where phosphate deficiency **did** exist, 28 lb of double superphosphate plus 56 lb sulphur per acre was the best treatment for the initial dressing.

2 On unimproved browntop and fescue foothill country (for example, Kakahu and Opuha silt loams) the pattern of responses was different. In contrast to the tussock hill and high country marked responses to the application of phosphate, sulphur, and molybdenum were seen. Where any one was not applied clover growth was severely restricted, plants remaining small leaved and yellow.

On this class of country, which extends the length of South Canterbury between the tussock hill country and the clay downs, 112 lb of double superphosphate plus 56 lb of sulphur and 5 oz of sodium molybdate per acre gave the best results. Quicker clover establishment and growth were obtained where 1 ton of lime per acre was also topdressed, but because of the steepness of much of this country the application of lime is often impracticable.

3 On the improved lower country other than the clay downs (for example, Templeton and Lismore silt loams) similar sulphur responses to (2) were obtained. This was particularly so on the lighter, freer-draining soils, good sulphur responses being seen on land which had received 4 cwt of superphosphate per acre within five years of the laying down of the trials. These responses were obtained possibly because such soils are free draining and the sulphur applied in the superphosphate was readily leached; or they may have an acute sulphur deficiency and require heavy applications of sulphur.

4 On the clay downs (for example, Claremont, Timaru, and Opuha silt loams) and very highly improved country of the freer-draining soils (for example, Templeton and Lismore silt loams) sulphur responses were not clearly defined, probably because frequently such land had a history of heavy superphosphate topdressing. In most of these areas 3 to 10 cwt of superphosphate had been applied, by either drilling or topdressing, within five years of the trial's commencement. However, two trials on the clay downs which had received little topdressing (1 to 2 cwt) in the previous five years showed good sulphur responses.

It appeared from these results that the heavy superphosphate applications before the sulphur trials were laid down had satisfied the pasture requirements for both sulphur and phosphate. This perhaps was the reason for no further visible responses to the application of additional sulphur as in the trial plots. Superphosphate plots alongside the rates of phosphate x sulphur treatments also failed to show any pasture response compared with no manure.

Though no visible responses were obtained from any manurial applications in many trials on the clay downs and highly improved soils, it was possible that there were responses which were too small to be detected visually.

By 1958 it was apparent that in future sulphur trials on such soils the pasture would have to be mown and weighed to determine any differences in production resulting from the various treatments.

In 1959 two phosphate x sulphur pasture mowing trials were laid down. The first was topdressed on a pasture which had not been topdressed for at least the previous eight years. This trial is showing good responses to 56 lb of sulphur per acre with additional responses to phosphate in combination with sulphur.

Yields in green weight per acre for the period 19/10/59 to 19/1/60 were:

		With 1 ton lime also applied
	lb	lb
Control	2,140	2,110
56 lb sulphur	2,610	2,720
112 lb double super. ..	2,280	2,300
56 lb sulphur + 112 lb double super.	3,510	3,000

The second trial was topdressed on a two-year-old pasture on which superphosphate had been applied in each of the previous four years. To date this trial has not shown significant responses to any manurial application.

Large sulphur responses in two trials laid down within 400 yd of the sea indicated that proximity to the coast appears to have little effect on the occurrence of sulphur deficiency in South Canterbury.

In all trials before 1958 which showed sulphur responses the 56 lb rate of application gave the best

One hundredweight of double superphosphate gave results similar to those from ½ cwt (illustration at left).

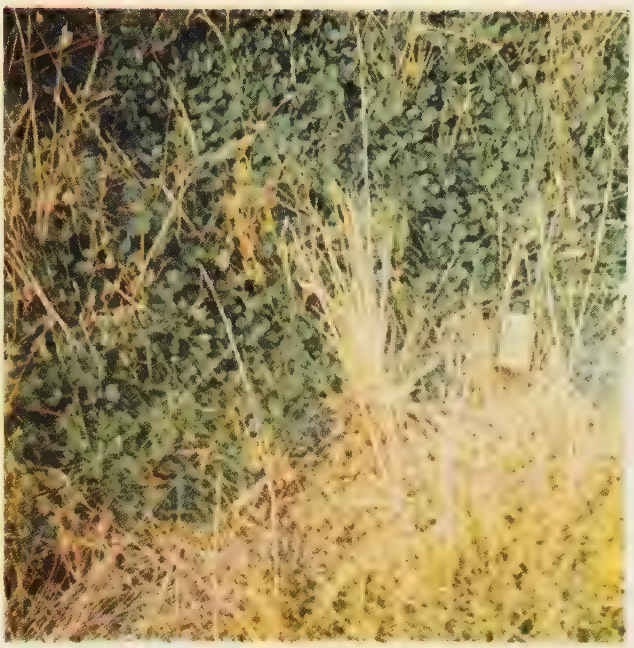
results. However, as this rate was the heaviest used in any trial it was possible that heavier dressings of sulphur would have given even larger increases in pasture growth. For this reason a new series of sulphur trials was laid down in 1958-59 and included 50, 100, and 200 lb of sulphur per acre.

In all of them little additional response has been obtained from rates above 50 lb, clover in several trials being actually thinner and less vigorous at the 200 lb rate.

Recommendations from Trial Results

The trials to date have shown that sulphur deficiency definitely exists in South Canterbury tussock hill country and that when such country is being topdressed more emphasis should be placed on the sulphur content of the fertiliser used. The present district practice is to topdress with 1 to 1½ cwt of superphosphate per acre. At this rate of manuring not more than 12 to 18 lb of sulphur per acre is applied.

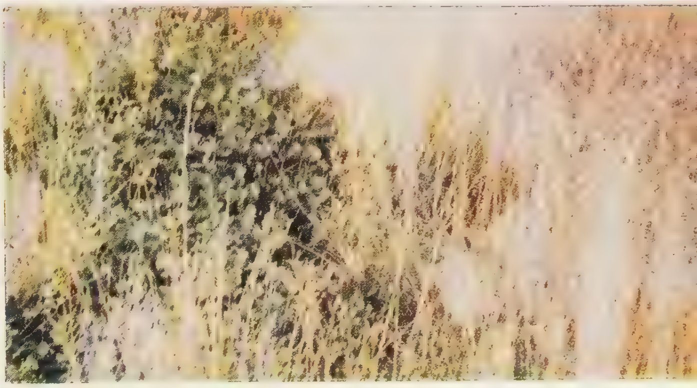
▼ Fifty-six pounds of sulphur strip, showing excellent take and extreme vigour of the clovers. (Fifty-six pounds of sulphur alone was slightly inferior to 56 lb of sulphur plus phosphate, owing to phosphate deficiency.)



Twenty-eight pounds of double superphosphate plus 14 lb of sulphur below the matchbox and 28 lb of double superphosphate plus 56 lb of sulphur above the matchbox, showing increased clover density and vigour with increased sulphur application.

Green, vigorous clover mat with 112 lb of double superphosphate plus 56 lb of sulphur.

▼ Very good take of clovers with 2 cwt of superphosphate. Control on right.



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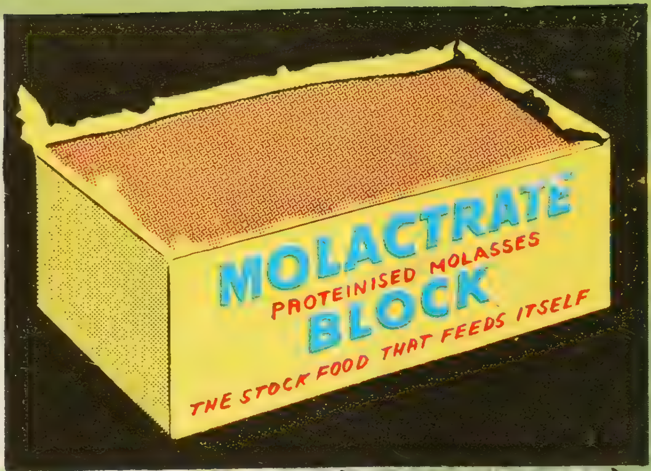
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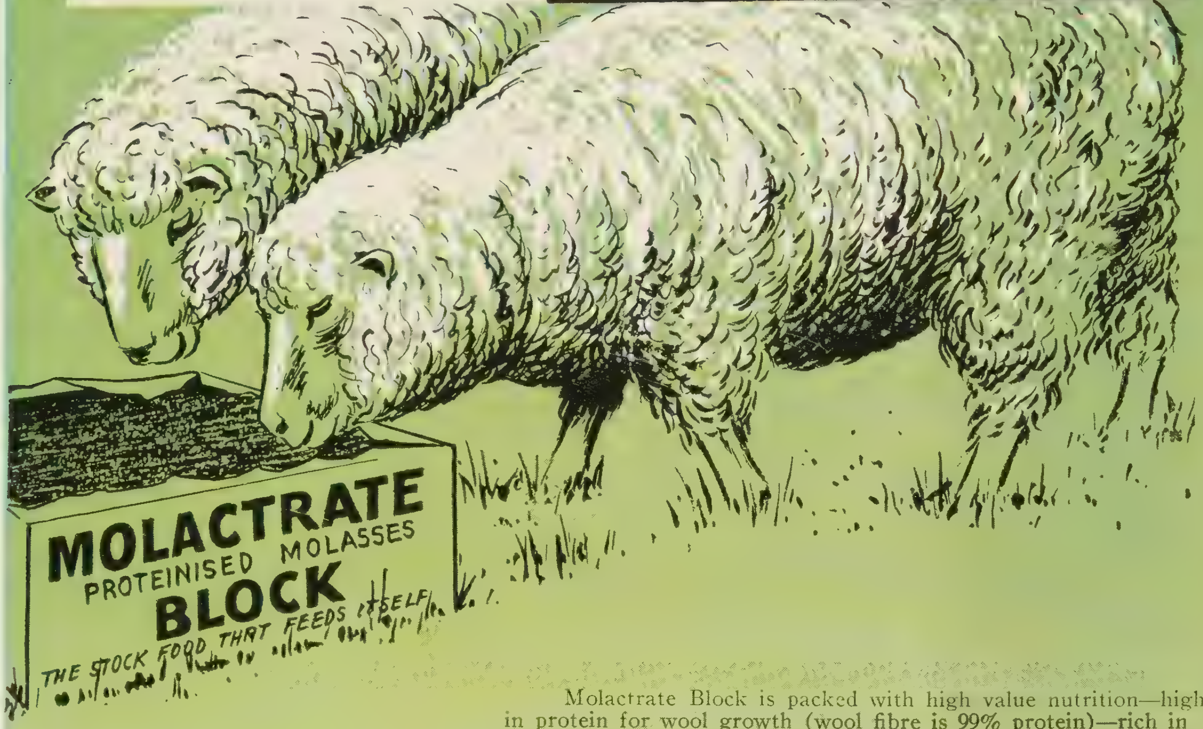
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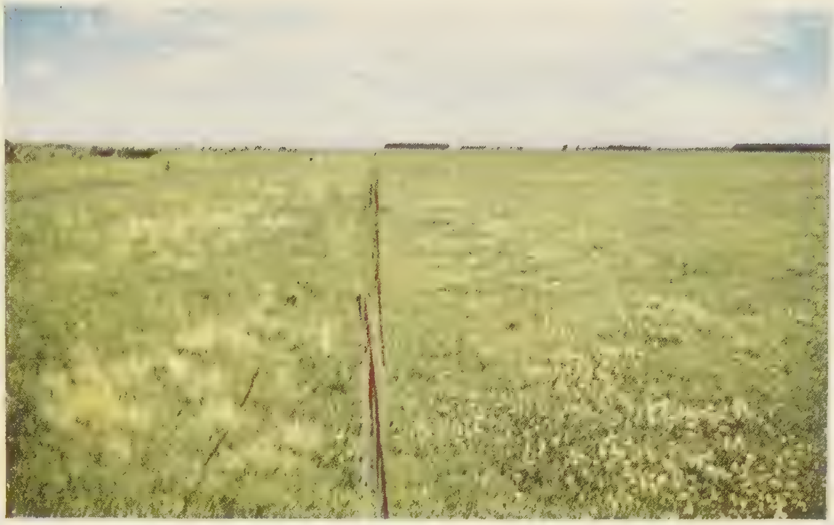
From trial results this is not enough. By increasing the amount of sulphur and reducing the relative amount of phosphate, pasture production increases can be expected. At the same time both cartage and aerial topdressing costs will be reduced.

Mixtures of superphosphate and sulphur which contain up to an extra 800 lb of sulphur per ton are now available; 1 cwt of this 800 lb mix contains 48 lb of sulphur compared with 12 lb in 1 cwt of 44/46 superphosphate.

The table at the top of page 233 will give some idea of the relative costs of various mixtures of sulphur and superphosphate, the amount of sulphur each contains, and the amount and cost of 44/46 superphosphate required to supply the same amount of sulphur as each mixture.

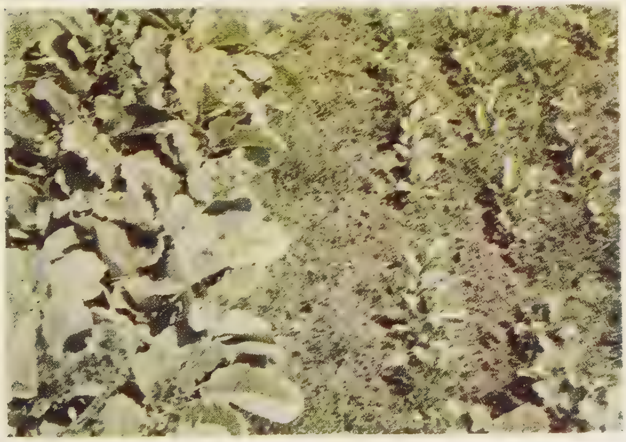
On the unimproved browntop and fescue foothill country, where high rates of sulphur, phosphate, and molybdenum are required, 2 cwt of a 400 lb of sulphur added per ton of molybenised superphosphate mixture appears to be the best fertiliser application.

On improved country, particularly the clay downs, sulphur responses in trials have not been nearly as clear cut as those in trials on the tussock

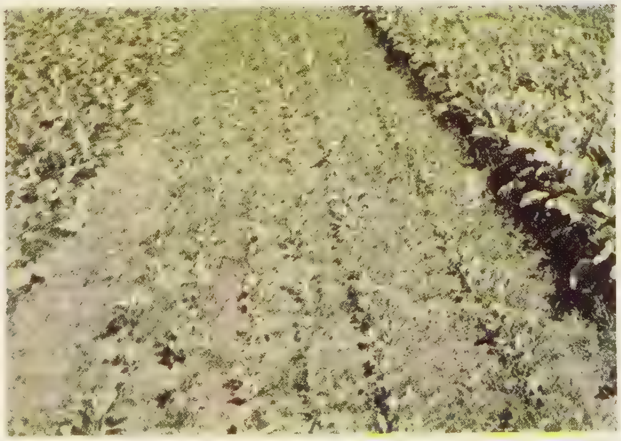


Sulphur-responsive plains soil, → showing area oversown with 2 lb of white clover and topdressed with $1\frac{1}{2}$ cwt of superphosphate on right and unimproved on left.

Pasture on highly improved → downs typical of country which shows few pasture trial responses to sulphur. This is probably due to previous heavy applications of superphosphate, which may have satisfied earlier sulphur deficiency.



Kale trial, showing growth from $1\frac{1}{2}$ cwt of reverted superphosphate on left and 160 lb of gypsum on right.



Kale trial, showing growth from $1\frac{1}{2}$ cwt of reverted superphosphate (left), 160 lb of gypsum (middle), and 3 cwt of reverted superphosphate (right).

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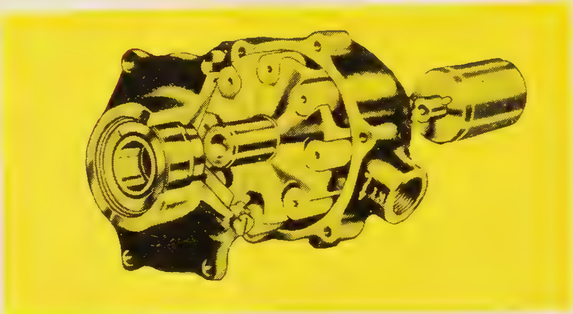

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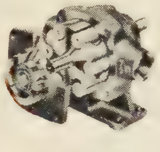

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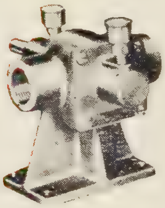

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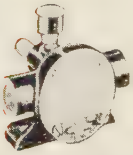

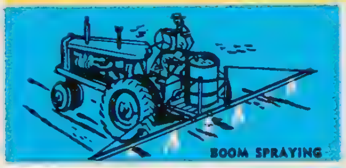

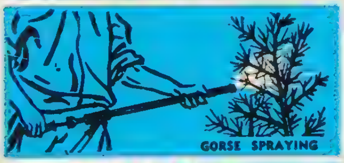

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RELATIVE COSTS OF VARIOUS MIXTURES OF SULPHUR AND SUPERPHOSPHATE

Mixture	Cost per cwt	Sulphur content per cwt	Amount of 44/46 super. required to supply the same amount of sulphur	Cost of this amount of super.
	s.	lb	cwt	£ s. d.
44/46 superphosphate	10	12	—	—
44/46 super. + 800 lb sulphur added per ton	18	48	4	2 0 0
2 parts super. : 1 part sulphur	14	45	3¾	1 17 6
1 part super. : 1 part sulphur	16	62	5	2 10 0

Costs are based on agricultural sulphur at £22 per ton and 44/46 superphosphate at £10 per ton

hill country. However, this does not imply that such soils are not sulphur responsive. Several sulphur trials, including a mowing trial, on areas previously little topdressed have shown good responses and indicate that, as on the hill country, superphosphate plus sulphur mixtures could be used to advantage. Such fertilisers could be either the commercially available superphosphate with sulphur added or a mixture of superphosphate and sulphur made up by the farmer.

These topdressing recommendations are for the initial application only. We do not know how long the responses to the first topdressing will last, though trials laid down in 1957 are still showing striking responses to the 56 lb of sulphur rate. If this high rate of application is used, repeat topdressings may be required less frequently.

Agricultural sulphur has been recommended in preference to gypsum for the following reasons, which are based on field experience with farmers and 12 trials.

- Gypsum varies greatly in fineness, purity, and sulphur content.
- Gypsum is frequently lumpy and tends to spread very unevenly from the air.
- 1 cwt of gypsum contains about 19 lb of sulphur; that is, 3 cwt of gypsum would be required to supply 57 lb of sulphur.
- In terms of equivalent sulphur, gypsum is more bulky than agricultural sulphur and therefore more costly both to transport and topdress by air.
- Though gypsum supplies sulphur in a form more readily available to plant, than does agricultural sulphur, the latter appears just as quickly available if the rainfall is adequate. For example, clovers oversown in sulphur trials laid down in the hill country in July-August 1956 failed to establish until the following autumn, owing to summer drought. However, similar trials laid down in July-August 1957 showed excellent clover establishment in the sulphur plots by December, owing to wet weather in spring and early summer. Under dry conditions gypsum will tend to stimulate clover growth while agricultural sulphur remains inactive. This was seen in a 1955 trial which compared sulphur and gypsum. In the second year of this trial (1956) under wetter conditions the two forms of sulphur gave the same clover responses.

Crop Trials with Sulphur

In direct contrast to the results from grassland experiments, which have shown the importance of sulphur in South Canterbury pasture production, crop trials have indicated the relative importance of sulphur and phosphate in cropping to be exactly the reverse. That is, crops require phosphate and, at most, relatively little sulphur, and pastures require more sulphur and less phosphate than was realised in the past.

Rape Manurial Trials

In 1955 two rape manurial trials were drilled in South Canterbury. These compared gypsum (used because it had more bulk for drilling than agricultural sulphur) with different rates of reverted superphosphate. One trial was on the Timaru downs, the other on heavy flat land.

In both trials the rape in the gypsum plots was very slow to establish, plants emerging two to three weeks later than those drilled with reverted superphosphate. For the next four to six weeks plants in the gypsum treatment remained yellow and unthrifty. However, by the time the crop was ready to be fed off these plants had made good recovery and were little inferior to those in the phosphate treatments. At this stage the trials were sample harvested and gave the following yields:

1955 RAPE MANURIAL TRIALS

Treatment	Tons green weight per acre Timaru downs (Hadlow)	Heavy flat land (Rosewill)
130 lb gypsum	11.9	21.5
1 cwt reverted super. ..	13.7	23.0
2 cwt reverted super. ..	14.3	24.9

In 1957 a further rape manurial trial was drilled on a South Canterbury downs farm (Southburn). For the gypsum treatment the pattern from drilling until sample harvesting was almost identical with the gypsum responses observed in the rape trials drilled two years previously. That is, plants sown with 160 lb of gypsum per acre were very slow to establish, remained yellow and unthrifty for four to six weeks after drilling, and finally made quite good recovery. At sample harvest (just before feeding off) this trial gave the following yields:

1957 RAPE MANURIAL TRIAL ON DOWNS (SOUTHBURN)

Treatment	Yield (tons green weight per acre)
160 lb gypsum	20.6
1½ cwt reverted super. ..	21.6
3 cwt reverted super. ..	21.8
1 cwt double super.	21.3

Note: The trial was complicated by ammonium nitrate-lime mixture treatments; the figures quoted are those when this material was used at 1 cwt per acre. There was a highly significant ammonium nitrate-lime x other treatment interaction which was peculiar and difficult to explain.

In 1958 two further rape manurial trials were drilled. The treatments included no manure; 2 cwt of gypsum; 2 cwt, 4 cwt, and 6 cwt of reverted superphosphate; and 1½ cwt of double superphosphate per acre. In the month before a severe hailstorm wiped them out in February 1959, both trials were showing marked responses to phosphate and no response to sulphur. Plants in the no manure and 2 cwt of gypsum plots were similar. They lacked density, being pale green and of poor vigour, while the phosphate treatments were dense, dark green, and vigorous.

Kale and Chou Moellier Manurial Trials

Kale and chou moellier manurial trials drilled in 1957 showed marked differences at all stages of growth and gave very interesting yield results. In both trials plants in the gypsum treatment emerged as seedlings two to three weeks later than those drilled with phosphate. However, in contrast to results observed in the rape manurial trials, such plants never made satisfactory growth and remained yellow and unthrifty until feeding off.

Compared with the 160 lb of gypsum treatment, the phosphate treatments in the kale and chou moellier trials gave very large increases in production.

Sample harvesting just before feeding off gave the following yields:

KALE AND CHOU MOELLIER MANURIAL TRIALS ON TIMARU DOWNS (KINGSDOWN)

	Tons green weight per acre Chou moellier Leaf	Stem	Total	Kale
160 lb gypsum ..	4.6	2.1	6.7	4.3
1½ cwt reverted super.	6.7	5.7	12.4	13.4
3 cwt reverted super.	6.9	6.0	12.9	15.0
1 cwt double super. ..	6.6	5.9	12.5	13.0

When the kale trial was fed off both cull ewes and fattening lambs preferentially grazed the "supered" plots and completely ignored the gypsum treatment.

Chou moellier manurial trials drilled in 1958 showed the same marked differences between phosphate and no phosphate at all stages of growth and in final yield, as did the 1957 chou moellier trial. Sample harvesting (just before feeding off) gave the following yields:

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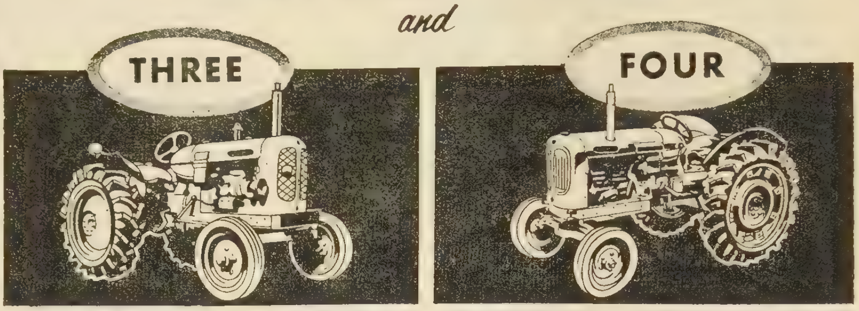

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CHOU MOELLIER MANURIAL TRIALS 1958-59

	Tons green weight per acre					
	Kingsdown			Bluecliffs		
	Leaf	Stem	Total	Leaf	Stem	Total
No manure	7.1	5.6	12.7	9.7	11.7	21.4
2 cwt reverted super.	10.2	10.2	20.4	11.8	16.7	28.5
4 cwt reverted super	10.5	10.8	21.3	12.5	18.0	30.5
1½ cwt double super.	9.3	9.7	19.0	11.9	17.1	29.0
2 cwt gypsum	7.1	5.5	12.6	10.0	12.2	22.0

Swede and Turnip Manurial Trials

In 1955 a swede manurial trial comparing the same manures as in the 1955 rape manurial trials was drilled on steep downs country. Unfortunately, the trial was not sampled for yield because of severe aphid infestation which was followed by mosaic infection. However, until the trial was abandoned it was obvious that the gypsum treatment was far inferior to the various rates of reverted superphosphate. Plants sown with the former established late, remained retarded in growth, and were failing to bulb properly.

A second swede manurial trial drilled in 1957 followed exactly the same pattern, though once again the crop was not sampled for yield, this time because of weeds and uneven establishment.

Two swede manurial trials drilled in 1958-59 showed the same marked manurial differences as were apparent in the earlier trials, namely late establishment and retarded growth where phosphate was not drilled with the crop. Just before they were fed off the trials gave the following yields:

	Tons green weight per acre					
	Bluecliffs			Upper Waitohi		
	Bulbs	Tops	Total	Bulbs	Tops	Total
No manure	9.4	3.0	12.4	7.9	1.3	9.2
2 cwt reverted super.	14.5	6.1	20.6	19.3	2.4	21.7
4 cwt reverted super.	15.5	7.3	22.8	26.4	3.3	29.7
1½ cwt double super.	14.0	4.5	18.5	17.1	1.7	18.8
2 cwt gypsum	9.5	3.7	13.2	9.3	1.5	10.8

The trials showed marked responses to phosphate while gypsum was little superior to no manure in total yield. There was, however, a tendency for sulphur to stimulate top growth in both trials, as shown in the table below.

Because swedes are slow growing and frequently weedy, sowing manure that did not contain sulphur could mean less top growth, poorer weed smother, and reduced yields of both tops and bulbs. This was particularly true of the Waitohi trial, which was very weedy, 4 cwt of reverted superphosphate yielding 26.4 tons of bulbs compared with only 17.1 tons from the purely phosphatic double superphosphate.

	Tons green weight per acre			
	Bluecliffs		Upper Waitohi	
	Bulbs	Tops	Bulbs	Tops
No manure	9.4	3.0	7.9	1.3
2 cwt gypsum (sulphur only)	9.5	3.7	9.3	1.5
1½ cwt double super. (phosphate only)	14.0	4.5	17.1	1.7
4 cwt reverted super. (phosphate plus sulphur) ..	15.5	7.3	26.4	3.3

With swedes showing marked responses to phosphate and (apart, possibly, from stimulated top growth) little response to sulphur, it was decided to see if the same differences occurred with white-fleshed turnips. Accordingly two manurial trials with this crop were drilled in 1958-59.

As expected, white-fleshed turnips showed the same striking differences between phosphate and no phosphate as was seen in the swede trials. Late establishment and poor growth with small, olive green plants were observed initially in the no-manure and gypsum plots of both trials. However, in the Bluecliffs trial by the time the crop was ready to be fed off the turnip tops were more dense, more vigorous, and later maturing in all plots containing sulphur; that is, gypsum compared with no manure and reverted superphosphate compared with double superphosphate.

However, the bulbs were higher yielding where there was less top growth and it was possible that sulphur had stimulated top growth at the expense of bulb formation. Just before they were fed off the two white-fleshed turnip manurial trials gave the following yields:

	Tons green weight per acre					
	Bluecliffs			Orton		
	Bulbs	Tops	Total	Bulbs	Tops	Total
No manure	12.0	5.1	17.1	5.4	4.4	9.8
2 cwt reverted super.	15.7	10.8	26.5	8.0	5.6	13.6
4 cwt reverted super.	17.8	14.0	31.8	8.7	6.5	15.2
1½ cwt double super.	20.7	7.9	28.6	8.3	5.8	13.8
2 cwt gypsum	11.3	9.0	20.3	5.2	4.2	9.4

The tendency for sulphur to stimulate top growth at the expense of bulb formation in the Bluecliffs trial is seen in the following table:

	Tons green weight per acre	
	Bulbs	Tops
No manure	12.0	5.1
2 cwt gypsum (sulphur only)	11.3	9.0
1½ cwt double super. (phosphate only)	20.7	7.9
4 cwt reverted super. (phosphate plus sulphur) ..	17.8	14.0

The Orton white-fleshed turnip trial was first drilled on 31/1/59 and redrilled on 24/2/59 because of poor establishment of plants after a severe hailstorm. The redrilling was made on a new site in the same paddock, which had already had 2 cwt of reverted superphosphate as a result of the farmer's manuring of 31/1/59. Despite this manuring three weeks before the trial was resown quite marked differences between phosphate and no phosphate treatments were obtained. Though top growth was not superior in the redrilled sulphur plots (possibly because of residual sulphur in the reverted superphosphate drilled three weeks earlier), it appears that for white-fleshed turnips to take full advantage of phosphate the seed has to be drilled with the manure.

The tendency for sulphur to stimulate top growth was thus seen in both the swede and soft turnip trials. Because swedes are slow growing and often weedy, the addition of sulphur to promote top growth and weed smother is probably an advantage. Turnips, however, grow rapidly and weed problems are infrequent. Consequently if sulphur stimulates top growth at the expense of bulb formation in soft turnips, a purely phosphatic manure should be drilled, as bulbs and not tops are required. The earlier maturity obtained with double superphosphate compared with reverted superphosphate may also be important, as farmers are tending to sow turnips later to escape virus infection and thus require a quick-growing crop.

The effects of sulphur on top growth and phosphate on bulb formation in swedes and turnips is being investigated in rates of phosphate and sulphur trials.

The rape, kale, chou moellier, swede, and white-fleshed turnip manurial trials have shown the importance of phosphatic fertilisers in the growing of these crops; sulphur plays a minor role in their production on these soils. Sulphur could be an advantage for swedes and a disadvantage for soft turnips. Rape sown without phosphate suffers an initial check in growth, but appears to be able to recover from such a check.

In the chou moellier, kale, swede, and white-fleshed turnip trials, however, plants in the no manure and gypsum treatments were permanently retarded. It is possible that the rape crop's phosphate requirement is less than that for swedes, white-fleshed turnips, chou moellier, or kale. This would account for the yield differences between gypsum and the various rates of phosphate in the rape trials being so much less than the differences between the same treatments in the other four crops.

Trials with Cereals

In cereal trials throughout South Canterbury increases in yield have seldom been gained by applying fertilisers to autumn-sown wheat. In 20 wheat manurial trials over the last five years the average increase in yield obtained from either 1 cwt or 2 cwt of superphosphate drilled with the seed was only one bushel per acre. In a recent spring-sown manurial trial (the first in South Canterbury for many years) 1 cwt of superphosphate gave an increase in yield over no manure of 10 bushels per acre.

Four trials in 1956-57 compared no manure with 2 cwt of superphosphate, 1 cwt of double superphosphate, and 1 cwt of gypsum. Though for the first three or four months after drilling (in autumn) establishment was slower and plant vigour was poorer on both the no manure and 1 cwt of gypsum trials than on those to which phosphatic fertilisers were applied, no differences could be detected after October. The trials gave the following yields.

	Bushels per acre			
	Studholme	Morven	Milford	Fairview
No manure ..	83	85	53	75
2 cwt super. ..	86	85	54	78
1 cwt double super. ..	86	87	56	78
1 cwt gypsum	88	86	56	77

Differences in yield are not significant. Gypsum in these trials caused neither an increase nor a depression in yield. Trials to date do not suggest that the inclusion of sulphur at sowing is essential for high wheat yields.

Though spring-sown oats and barley trials in South Canterbury have shown marked responses to superphosphate, no local work has been done with oats to compare gypsum, double superphosphate, and superphosphate. Two barley trials comparing these manures were, however, drilled in 1958. Both showed very marked responses to phosphate from the time they were drilled, no manure and gypsum treatments being very yellow and unthrifty while all plots sown with phosphate were dark green and vigorous. One of the trials was wiped out by hail, but the second (at Studholme) gave the following yields:

BUSHELS PER ACRE

	Yield	Inc.
Double super:		
None	46	—
½ cwt	54	8
1 cwt	59	13
Gypsum:		
None	52	—
½ cwt	53	1
1 cwt	54	2

The trial showed large yield increases when drilled with phosphate and very small (but statistically significant) increases with gypsum. From the results it is probable that a manure containing both sulphur and phosphate (as in superphosphate) rather than a purely phosphatic manure should be drilled with barley. This is in line with present farm practice.

Conclusions

Sulphur investigations to date have shown that sulphur deficiencies exist in South Canterbury pastures and that the amount of sulphur relative to phosphate could be increased for pasture topdressing. Because the present 44/46 superphosphate contains only 12 lb of sulphur per hundredweight, some sulphur-enriched fertiliser which increases the rate of sulphur is recommended.

On the browntop and fescue foothill country high rates of sulphur and phosphate and some molybdenum are essential for good pasture growth. On the tussock hill and high country the emphasis should be on an increased dressing of sulphur rather than phosphate. The same conclusions, as seen from the results of several observational trials and one mowing trial, probably apply to the South Canterbury downs and alluvial soils. Some phosphate should be applied, as some of the trials indicated a marginal phosphate deficiency.

Crops

Crop investigations on the other hand have shown that phosphate is more essential than sulphur for rape, swedes, white-fleshed turnips, chou moellier, and kale. Sulphur may be an advantage sown with swedes, but a disadvantage when sown with white-fleshed turnips.

On farms where mixed cropping is done in conjunction with fat lamb production it appears likely that more emphasis could be placed on phosphate for the crops and sulphur for the pastures. It is possible, though not yet proved, that South Canterbury soils which have been well treated with superphosphate in the past will require only sulphur for their maintenance while in grass. It is also possible that such pastures which are in grass for only four to six years may not need maintenance dressings of any kind. This is being investigated in pasture topdressing mowing trials.

Where either little or no superphosphate has been used, the use of a sulphur-enriched superphosphate for pasture topdressing would be advisable.

Close Watch for Nassella Tussock in Northland

A CLOSE watch will be kept by Department of Agriculture officers for nassella tussock in areas of Northland near that at Topuni where the weed was found on two farms toward the end of last year. All the plants that could be discovered on the Topuni farms were grubbed out and careful re-inspections of these properties will be made to trace any plants that may have been missed.

To help farmers in Northland, most of whom have no experience of nassella, to recognise the weed the Department has prepared exhibits of specimens of nassella, which will be widely displayed.

So far the Department has been unable to establish how nassella reached Northland, though the most likely means is as an impurity in pasture or crop seed.

Unfortunately the nassella infestations were identified in Northland at a time when there was rank growth on many farms and this made a thorough search for the weed most difficult. A further careful inspection will be made when pastures throughout the area are more closely grazed and nassella plants should be much easier to see.

Serious Weed

Nassella tussock has been recognised as a very serious weed in parts of North Canterbury and Marlborough for well over 20 years and about 110,000 acres there are infested to some extent. Isolated tussocks have also been found on farms in other parts of Canterbury.

County councils in areas where the weed occurred were empowered in 1943 to control it, and in 1946 the Nassella Tussock Act was passed, providing for the setting up of two boards, one in North Canterbury and the other in Marlborough, to undertake control measures. These boards have since operated under subsidy from the Government and a considerable sum has been expended each year on controlling the weed and on improving methods of doing this.

Nassella is one of the "tumble weeds" the fruit-bearing portions of which are dispersed by wind. During December and January in infested localities flower parts are commonly seen in the air on windy days. Masses of straw and seed lodge on the windward side of fences and shelter belts. This windward spread of seed on some days is said to resemble a snowstorm. During the dispersal period large quantities of seed are deposited over arable land, pastures, and riverbeds near established blocks of tussock.

Vegetable Growing for HOME and MARKET GARDENERS

[*Sparrow*

Cabbage Growing

By A. G. KENNELLY,

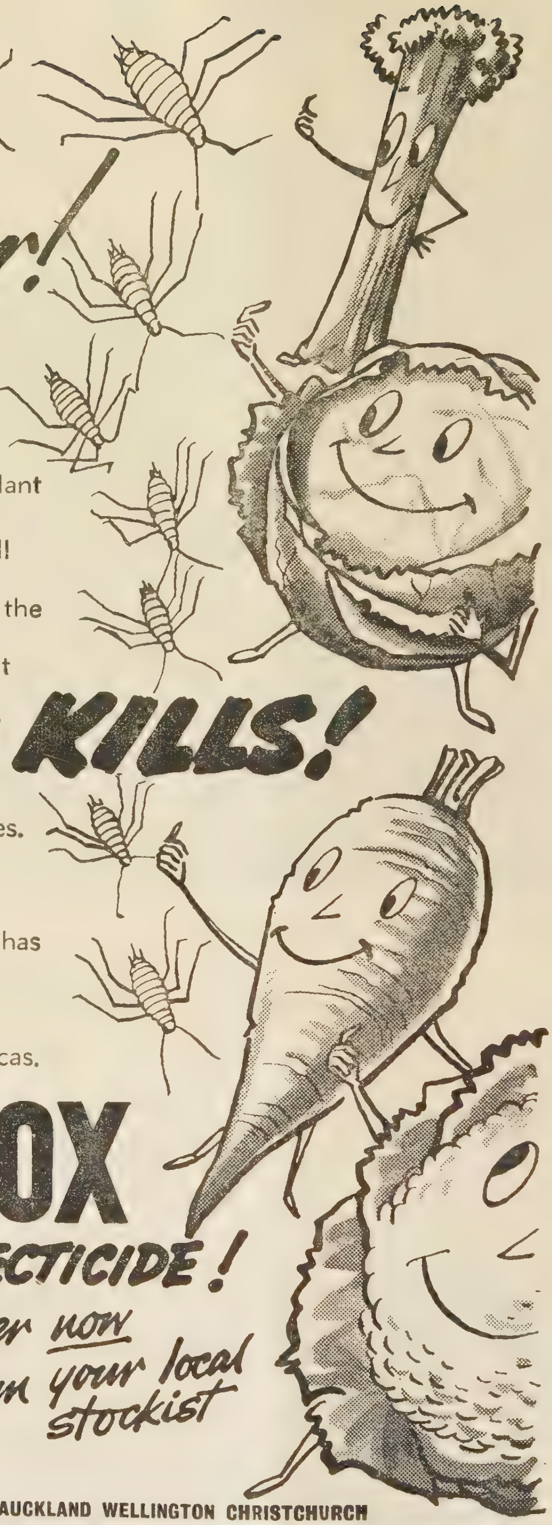
Horticultural Instructor, Department of Agriculture, Dunedin

THE main types of cabbage grown in New Zealand are the smooth-leafed, pointed (conical or "spring") cabbage, the smooth-leafed, globular (round or ballhead) cabbage, and the drumhead (round, flat-topped) cabbage, with which is included the red or pickling cabbage and the savoy (Milan or "winter") crinkle-leafed cabbage. Cabbage succeeds best in cool, moist climates, though some varieties do well in fairly hot conditions if there is enough moisture. Cabbage grows best in a deep, rich, well drained soil containing plenty of organic matter, though like most members of the brassica family (for example, kale, brussels sprouts, and broccoli), it succeeds on a great variety of soils if there is ample plant food and if moisture and drainage are satisfactory. Light soils are usually more suitable for early crops.

CABBAGE has a strong root system, most of which develops in the upper foot of soil, but in favourable conditions some varieties may produce a network of roots 3 ft wide and even deeper than that. Plants may be checked if roots are damaged in cultivation.

Rotation of crops is important where cabbage is grown, particularly to avoid a build-up of soil-borne diseases. Heavy dressings of organic material, such as farmyard manure or poultry manure, or ploughing in of heavy green crops, are necessary on most soils where adequate rotation of crops is not practicable.

Cabbage is a gross feeder and makes a quick response to favourable conditions. Quality is closely related to quick growth, and moisture, good soil tilth, and liberal fertiliser applications contribute to favourable conditions. Cabbage heads may burst when nearing maturity if rain follows a dry period because of the sudden burst of growth; the most effective preventive is to check growth by damaging the



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root system. This is not always practicable, but can usually be done most simply by close, deep cultivation which breaks the roots and reduces the intake of soil moisture.

Cabbage responds well to irrigation and in dry conditions summer and autumn cabbage may benefit by three or four irrigations. Late irrigations when the heads are maturing should be used with caution to avoid split or burst heads.

Manuring and Lime

To develop good heads plants need a ready supply of nitrogen, but too much nitrogen without balance of other elements may result in soft growth and spongy heads.

Unless the ground has been heavily fertilised for a previous crop and is already enriched it is usual to apply a fairly heavy dressing of a fertiliser rich in nitrogen and phosphate and often in potash also. Applications vary in districts from 10 to 20 cwt per acre. Many growers give in addition at least one side dressing of sulphate of ammonia or similar nitrogenous fertiliser (most commonly) or blood and bone or dried blood. Cabbages have a special need for nitrogen when well established and developing heavy leafage and the nitrogen in the base dressing may by then have become deficient for the good development of the plants.

A supply of readily available nitrogen in early spring, when temperatures are comparatively low, is important, as little nitrogen may be available at that time from the soil owing to slow breakdown of soil organic matter.

Fertiliser application for cabbage crops varies a great deal from district to district and the commercial grower if in doubt should consult the Department of Agriculture's local horticultural advisory officer about precise district practice.

Most growers broadcast fertiliser before planting. It is rarely applied by the plough sole or band method, though this method would be more economical of fertiliser with wider spaced planting. With closer planting and vigorous varieties broadcasting should give good results.

Cabbage grows well in a moderately acid soil, and lime, apart from its effect in controlling clubroot, is usually of benefit only on soils that are acid or moderately acid. Liming has long been regarded as a means of reducing clubroot disease. Recent experiments in Northern Ireland have shown that though clubroot can occur in alkaline soils, risks decrease with increasing alkalinity. Liming of soil that is only lightly infected may markedly reduce incidence of the disease.

Seeding

The advantages of developing high-producing, uniform strains of vegetable brassica varieties for New Zealand conditions was shown by investigations at the Crop Research Division of the Department of Scientific and Industrial Research, Lincoln.

Early maturing Government approved 'Best of All' savoy cabbage was released to the seed trade in 1956 for multiplication under the vegetable seeds agreement, and in 1958 a selected strain of the 'Omega' savoy cabbage was released. Work is proceeding on a strain of 'Flower of Spring' cabbage.

Poor seed stock and unfavourable environment both may cause poor heading. Bolting or the premature development of seed stalks may develop if a crop is sown in autumn and grown through low winter temperatures, particularly if the seed is sown early, because then the plants will be large when they are subjected to the low temperatures, which are the main factor in bolting. Aspects other than low temperatures which influence bolting include poor stock and increasing the size of the plants in the seedbed by use of fertilisers (though later application to the plants in the field has no such effect). The tendency to bolting is partly hereditary, but may be controlled or encouraged by environment.

Cabbage seed is usually drilled ¼ to ¾ in. deep in a seedbed at about 25 to 30 seeds to the foot in rows 9 to 15 in. apart, or broadcast thinly on beds about 3 ft wide. Seed is usually sown five to seven weeks, according to temperature and growing conditions, before the plants are required for setting out.

[*Sparrow*

Seedling cabbage in a commercial garden sown successionally to enable planting out to be spread through the season.

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Plants are usually transplanted when about 5 to 8 in. high, with a good root system and stems not quite as thick as a lead pencil. Uniform, well hardened, healthy, stocky plants with dark green leaves and good root systems should be selected for planting out.

Four ounces of seed sown thinly in good conditions will produce enough plants for an acre, but it is safer to sow 6 oz, and 8 oz may be needed for pointed or spring cabbage which is set out closely and harvested before it is fully mature.

Spacing and Planting

Early cabbage is usually planted 12 to 18 in. apart in rows 27 to 30 in. apart according to size of variety. The larger kinds may be set 18 to 30 in. apart in rows 27 to 30 in. apart. Winter cabbage is occasionally set 30 in. apart each way to permit cultivation each way. The largest varieties need more than 30 in., but they are seldom grown commercially.

Cabbage set out to overwinter in ground that lies cold and tends to be wet is usually set out on ridges or may be ridged in cultivation. With most varieties wide spacing tends to produce earlier, heavier, and larger heads, but yield per acre and number of heads harvested are usually increased by close planting.

Plants may be set out by hand with a trowel or dibble or mechanically by planter. Many growers dip the leaves of bundles of plants in insecticide before planting.

[*Sparrow*

Cabbage plants should be moulded to protect them from wind damage, to conserve moisture, and to encourage better rooting. Banking up the soil also has the advantage of destroying weeds.

In dry conditions, particularly during summer and autumn, watering in the plants during transplanting is advisable.

Main Varieties Used Commercially for Spring, Summer, and Winter Crops

	Pukekohe	Auckland	Otaki-Levin	Manawatu	Hawke's Bay	Nelson	Christchurch	Dunedin
Golden Acre ..	Su, W	Su	Su	Sp, Su	Su	Su	Su	Su
Green Acre ..	Su, W	Su						
Winter Pride ..	W	W			Sp	W		
Slowbolting Green ..	W	Sp, W	Sp					
Enkhuizen Glory ..	W	Sp, W					Su	
Greenback ..	Su	W			Sp			
Early Glory ..	W							
Enfield Market ..							Sp	Sp
Flower of Spring ..	Sp		Sp	Sp	Sp	Sp	Sp	Sp
Succession ..						Su, W	Su	Su, W
Omega				W	W	W	W	W
Best of All ..	W	W			W	W	W	W
Chieftain				W	Sp	W		
Copenhagen Market	W			Su	Sp, Su	Sp, Su	Su	Su
757			Sp				Sp	Sp
Greyhound ..							Su	
Ormskirk Strains ..							W	W
Savoy			W		W	W	W	W
Early Acre ..			Sp, Su					
Offenham					Sp			
Drumhead					W			
Red Pickling ..					Su			
Chinese Cabbage ..	W	W			W		Su	Su

Sp, spring; Su, summer; W, winter

Cultivation

Cultivation should be shallow, as the roots of cabbage may be more than half way across between the rows by the time the plants are half grown and many cabbage roots are within the top 2 to 3 in. of soil.

Banking the soil in ridges tends to improve drainage and soil temperatures, destroys weeds, and helps to prevent the plants being blown about by wind. Plants may be ridged early, or the ridging may be left until the last cultivation that can be given without damage to growing plants. Hand hoeings are necessary to remove weeds in the lines of plants or where the spread of the plants prevents the use of machinery.

Harvesting

Spring cabbage is usually harvested when the heads are reasonably full and firm enough for use. Summer and winter cabbage are not usually harvested until the heads are solid and practically mature. Care is necessary in packing and handling, as the heads of good-quality cabbage are readily damaged in handling and transit.

Features of Main Varieties

Details of some of the more important cabbage varieties grown commercially in New Zealand follow.

Golden Acre: A first early, small round variety having small, very solid heads. It commonly grows to a diameter of about 6 in., but does not do well in cold or severe weather.

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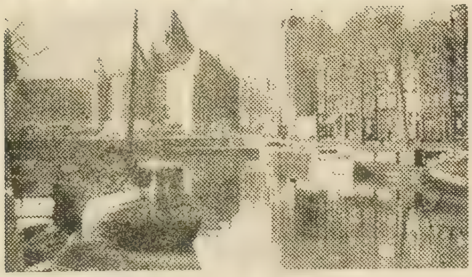

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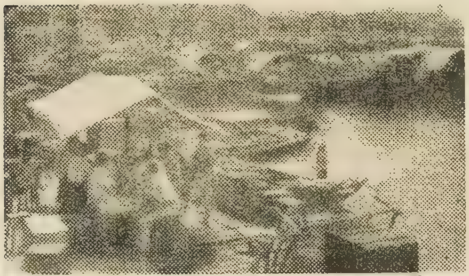

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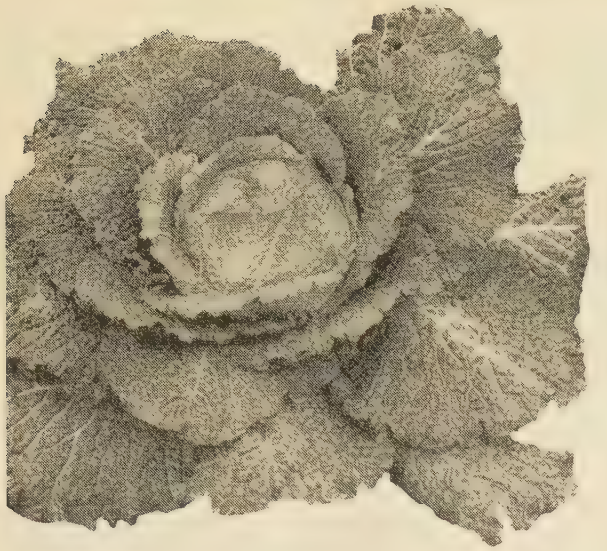
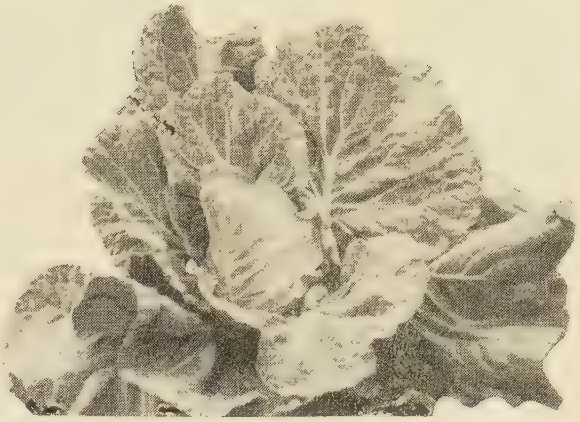
TYPES OF CABBAGE GROWN IN NEW ZEALAND



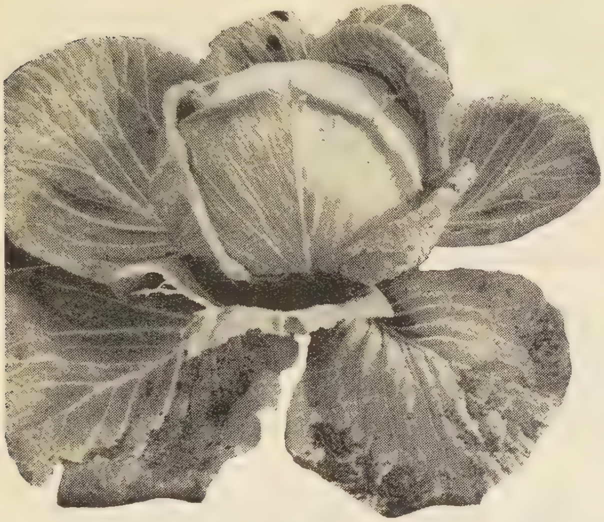
[*Sparrow*

Savoy (winter) cabbage.



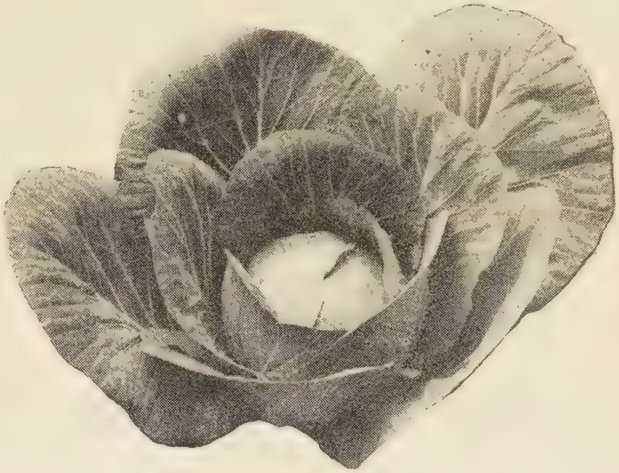
[*Sparrow*

Smooth-leafed, pointed or spring cabbage.



[*Sparrow*

Drumhead cabbage.



Smooth-leafed, round cabbage.

Copenhagen Market: A second early variety of medium size with medium sized heads. It is a short-stemmed ballhead maturing two to three weeks later than Golden Acre and is somewhat larger. It may grow to 4 to 6 lb and it stands well if the weather is reasonably cool.

Green Acre: An improved dark green strain of Golden Acre suitable for early autumn and spring planting. It is compact, quick growing, usually about 4 to 5 lb, and a little later maturing than Golden Acre.

Slowbolting Green: A variety with attractive bluish green, round, uniform, solid heads 7 to 8 in. wide, which are slow to burst and go to seed, particularly in late winter and early spring. It should not be sown too early.

Winter Pride: A dark green, compact, non-bolting ballhead with good cover leaves. It is suitable for sowing in all seasons in most districts.

Enkhuisen Glory: A second early to mid season, solid round, dwarf, compact variety well suited to spring sowing which generally produces good heads under quite variable conditions. The outer leaves protect the head well and the heads hold well under reasonably cool conditions.

Succession: Strains of 'Hendersons Succession' cabbage vary in size and are well suited to setting out in spring. Some of them grow to a considerable size if left. The best can be cut with heads of 10 to 12 in. diameter and are then firm and of fine quality. Some strains are too rank and coarse.

Springtide: A compact, firm, slightly pointed cabbage that is becoming popular with home gardeners. It appears suitable for spring, summer, and autumn production.

Early Acre: A first early variety which is a little earlier than Golden Acre. The heads are a little smaller, but the quality is equally good.

Offenham: The heads are large and solid and the hearts of good quality. The variety, which is an English one, is well suited to autumn sowing.

757: A good type of pointed cabbage with firm heads of good colour. It has not always overwintered well in the colder districts.

Spring Cabbage

Enfield Market: One of the oldest varieties grown. A popular second early or early main crop variety with many southern growers. Good strains are of good quality with firm, solid,

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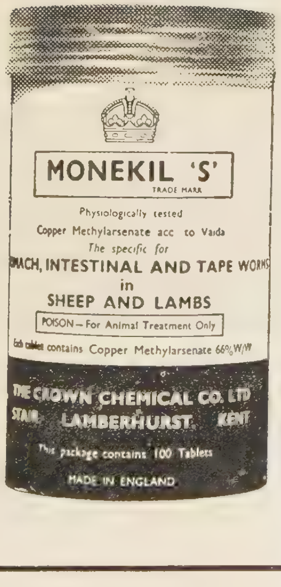
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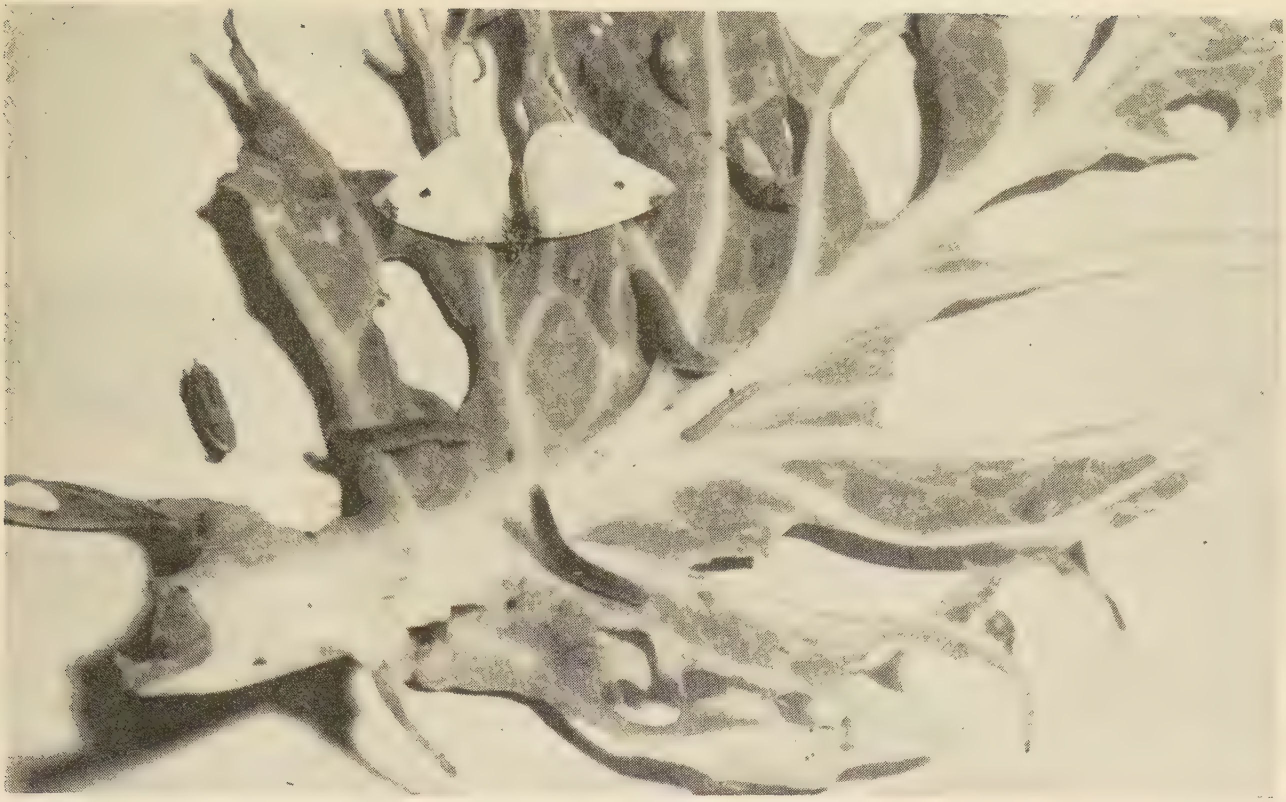

[Orr

The worst pest of cabbage is the white butterfly, the caterpillars of which rapidly damage a plant and make it unfit to market. Spraying against this pest must begin at the seedbed stage.

pointed heads which mature a little later than those of Flower of Spring.

Flower of Spring: An early, pointed, moderate sized quality cabbage well suited to autumn planting for early spring cutting. One of the most reliable varieties for overwintering in the colder districts.

Wheelers Imperial: This dwarf pointed variety is suited to autumn sowing. It matures about three weeks earlier than Flower of Spring.

Greyhound: A pointed variety of good quality and compact habit which can be planted closely and is best suited to spring planting.

Savoy Cabbage

Best of All (Government approved): The heads are even, medium sized, with dark glossy green, fine-textured leaves. Planted out in early March in Auckland and early January in Canterbury the variety matures in May.

Chieftain: An American variety suitable for early cutting which matures a little later than Best of All. It has light green savoyed leaves and firm heads well covered with overlapping leaves.

Omega: Omega is a very hardy, very late maturing savoy, the best strains of which have dark green uniform heads of average size.

Ormskirk: Strains are hardy types of savoy produced in the north of England. The heads are firm and flat and varieties with several maturity periods are available.

Pests and Diseases

Following are descriptions of some important pests and diseases of cabbage in New Zealand.

Mildew and Leaf-eating Pests (apart from slugs and snails)

Downy mildew usually appears first as white downy patches on the under surfaces of the seedling leaves which cause stunting and wilting; foliage may become yellow. Where infection is severe seedlings may be killed and mature plants may become susceptible to destruction by soft-rot organisms. Control consists of ensuring that ventilation, spacing, and drainage are good and spraying with copper oxychloride. Where caterpillars, cutworms, vegetable weevils, and thrips are also troublesome a spray made up of 5 lb of copper oxychloride, 1 lb of 50 per cent DDT, and 1 gallon of summer oil to 100 gallons of water may be used.

Clubroot

Clubroot affects all members of the cabbage family, including rape, swede, radish, and mustard, and also some ornamental cruciferous plants such as wallflower, stock, and candytuft and weeds such as charlock and shepherd's purse. The disease is caused by a fungus which enters the root system from the soil and results in the development of rounded or knobbly swellings which eventually decay in a smelly soft rot. The failure of the root system results in cessation of growth, and in severe attacks in death of the plants, but where infection is not so serious the plants may produce heads or may survive but wilt in hot weather, according to the degree of infection.

The role of lime in reducing attack by clubroot was mentioned on page 239. Seedbeds may be treated with a 0.1 per cent acidulated mercuric chloride solution. Four gallons of the solution should be applied to 2 sq. yd. of seedbed through the sprinkler of a watering can and the bed should be left for 10 days before sowing. To assist penetration of the seedbed a gallon of water can be applied about an hour after the treatment.

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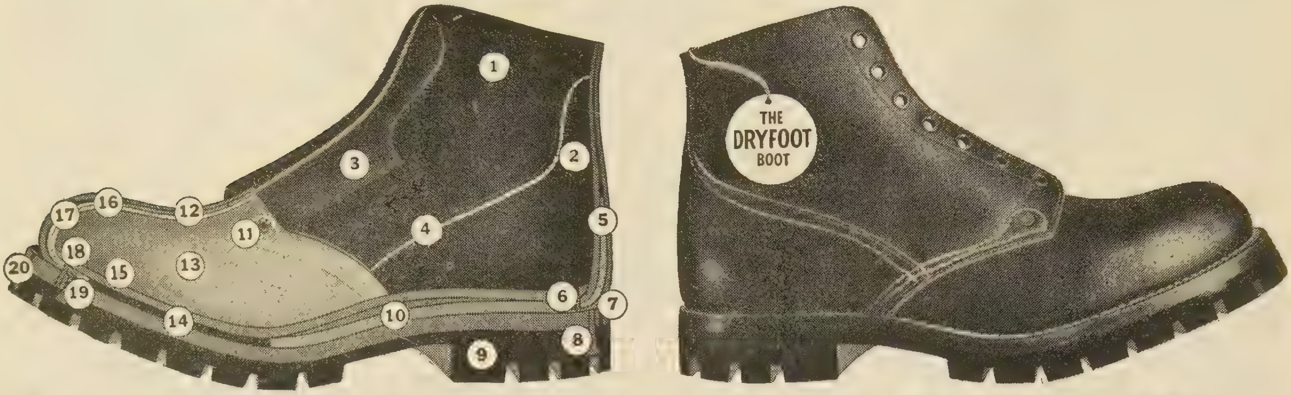

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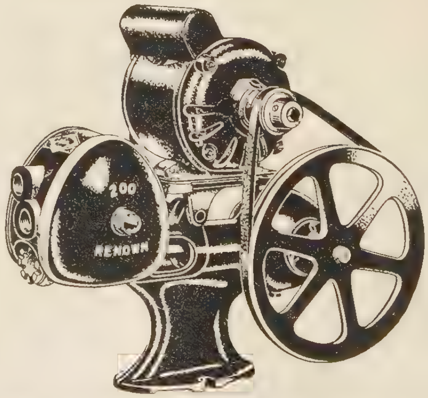

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In the field, apart from liming, as long a period as possible between cruciferous crops should be allowed and a basic manure such as basic slag is preferable to superphosphate for the seedbed. Satisfactory results are also obtained by applying a solution of acidulated mercuric chloride in the dibble holes several days before planting out.

Another simple method which usually gives a reasonable measure of control is to dip the roots of the seedlings in a solution of calomel. A paste can be made by mixing 1 lb of 4 per cent calomel dust with 1/3 pint (about 7 fl. oz.) of water. The seedlings can be bundled, the roots dipped in the paste so that they are thoroughly coated, and plants then set out. The paste should be made up in a wooden or earthenware container; 1 lb of 4 per cent dust should be enough for about 112 plants.

Damping off and Wire Stem

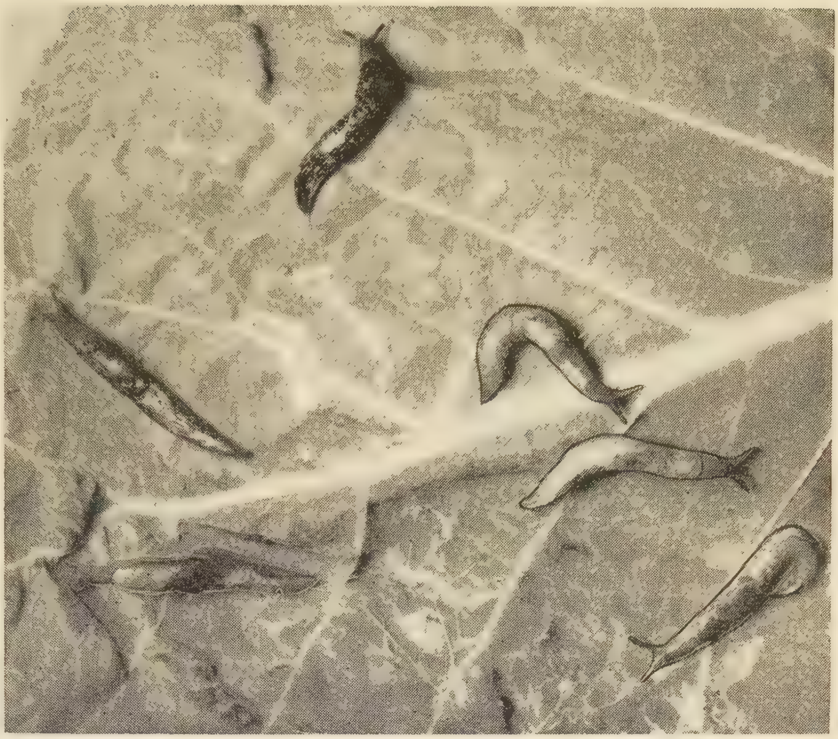
Damping off and wire stem caused by minor soil-borne organisms should be guarded against by rotation of crops and by the establishment of a seedbed in soil that has not grown brassicas for some time and is well drained and in a favourable situation. Seedling stems affected by damping off of the seedlings are softened and collapse at ground level.

Wire stem, which usually occurs at a later stage, causes the bases of stems to become hard, brown, and shrunken, or hard constriction of the stems may persist so that affected plants may be broken off in handling or by wind. Roots sometimes become so badly affected that the plants die. Seedbed soil may be sterilised by soaking with formalin (1 part to 50 parts of water) or by methyl bromide (1½ to 4 lb per 100 sq. ft.) released through special equipment which is available quite cheaply from retailers of methyl bromide. Dissipation of the fumes before sowing is essential and can be speeded by cultivation.

Ring Spot

Ring spot (*Mycosphaerella brassicola*) is most common where brassica crops are grown on the same ground year after year on soils that have been heavily manured. Brown more or less circular spots up to ½ in. in diameter are formed on the foliage and stems and are most abundant on the lower and outer leaves, which may become yellow and fall prematurely. The surface of the spots is dotted over with minute black fruiting pustules in concentric rings.

Where the disease is severe the seedbed should be isolated, rotation of crops practised, and diseased refuse destroyed. Some varieties of cabbage are more resistant than others and where growth is excessive and tends to be soft sulphate or muriate of potash at 2 to 3 cwt to the acre may make the plants more resistant.



[Green and Hahn

Slugs can be a serious nuisance in cabbage crops in the home garden and are best controlled with metaldehyde baits.

Leaf Spots

Leaf spots may be due to one of several diseases and are likely to be most troublesome in winter, late autumn, and early spring. Control consists of adequate spacing, balanced manuring, rotation of crops, destruction of rubbish, and in the more serious cases spraying with copper oxychloride.

Black Rot

Black rot (*Xanthomonas campestris*) is troublesome in some districts. First symptoms are yellowing of the leaves, usually beginning at the tips, with blackening of the veins. A characteristic black ring which is seen if stalks are cut across is caused by the bacteria in the water-conducting strands. Affected plants are seriously checked and may be invaded by secondary rots. The disease persists indefinitely in the soil and is nearly always seedborne.

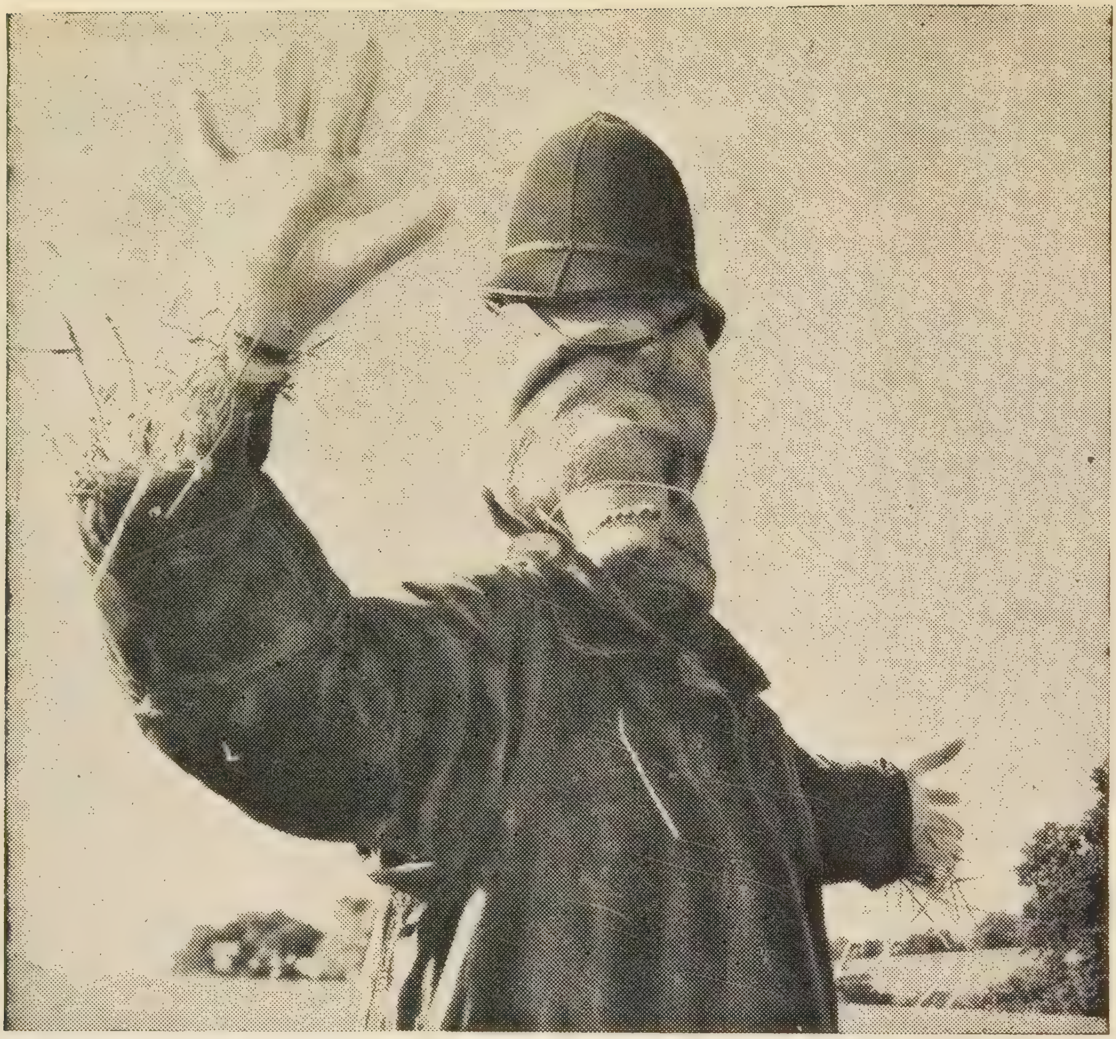
Suspected seed should be treated before use with hot water, but this must be done carefully, as the seed may be damaged and germination reduced, particularly with old seed. Seed should be steeped in water for 25 minutes at a temperature of 122 degrees F and afterward spread to dry in a warm room. High temperatures or direct sunlight should be avoided, as quick drying may affect germination. The correct temperature must be maintained for the period stated and an electric element and thermostat are necessary to hold the water to within ½ degree of that required.

When the seeds are dry they should be treated with a seed dust such as thiram to protect them from recontamination.

Cauliflower Mosaic

Cauliflower mosaic virus is one of the most serious diseases of brassicas in New Zealand. On spring cabbage the most common symptom is vein clearing (lightening in colour along the veins). Leaves of savoy cabbage become mottled with blotchy areas of pale green or yellowish tissue. Plants often fail to develop hearts, the leaves then forming loose rosettes. The disease is commonly spread by the grey cabbage aphid (*Brevicoryne brassicae*), though it may also be spread by other aphids. Host plants which may act as reservoirs of infection and so help to carry the disease over from one season to another include weeds such as hedge mustard and brassica seed crops.

A trial with cauliflowers in 1958 by the Plant Diseases Division of the



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What a fine figure of a scarecrow he is! Although bird traffic seems somewhat slack at the moment, who can doubt that those vast white gloves are capable of dealing with any emergency. Unfortunately, his command of the situation does not extend to the other pests of growing crops — the insects, the fungus spores and the weeds. To keep *them* under control the best weapons are agricultural chemicals from Shell.

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Department of Scientific and Industrial Research showed that though infection with the virus could not be prevented, infection was delayed by spraying the plants in the seedbed with a suitable systemic insecticide at regular intervals. This delay in infection resulted in a much higher percentage of marketable heads and a considerable gain in the average weight per head. The early spraying of seedlings with a systemic insecticide followed by a normal spraying programme after transplanting is an economic proposition and useful for commercial growers who are troubled with this aphid-borne disease.

Head Rots

Mature cabbage heads are made up of comparatively dormant tissue that becomes liable to the attack of disease organisms, many of which are of little danger to the growing plant. Many, though not all, gain entry through injuries which may not readily be discernible to the unaided eye, but the spread of most is facilitated by moist, humid conditions. Control usually consists of the destruction of rubbish and better aeration or spacing of the crop.

Slugs and Snails

The standard recommendation for the control of slugs in home gardens is a metaldehyde bait, usually made by mixing 2 oz of metaldehyde and 3 lb of bran. Though this has usually been regarded as impracticable for commercial growers, it gives good results broadcast on a field scale at 50 lb of bait per acre.

Dr H. Jacks, of Massey Agricultural College, conducted trials in the 1957-58 season in the Manawatu district in which he compared: (a) HETP (20 per cent tetraethyl pyrophosphate) used as a spray at 1 and 2 pints respectively in 100 gallons of water; (b) malathion (50 per cent emulsion) as a spray at 1¼ and 2½ pints respectively per 100 gallons of water; (c) metaldehyde baits made up of bran and 1 per cent of dried blood into which ground metaldehyde was mixed at 2 and 4 per cent respectively and the mixture spread at 3 ft and 5 ft intervals respectively at about 28 lb and about 40 lb per acre; (d) 0.02 per cent metaldehyde suspension used as a spray at 180 gallons per acre and also at a heavier rate; (f) calcium cyanamide broadcast at 3 and 6 cwt respectively per acre.

Calcium cyanamide is a fertiliser containing about 20 per cent of nitrogen and about 60 per cent of lime and is rather caustic to vegetation (specially prepared types have been used as weedkillers). It should not be applied within a week or so of seed sowing. In the soil it gives rise to calcium compounds equal to about 60 lb of quicklime per hundredweight of fertiliser and so is of some value on lime-deficient soils.

The most effective treatment was metaldehyde bait distributed either by hand or mechanically. The report stated that spraying may allow rapid coverage of areas, but as the poison acts mainly by contact, spraying would have to be done at night and at a considerable volume per acre, and this may be difficult or impossible on moist ground. As neither malathion nor metaldehyde spray was suitable, because of toxic residues, for use on crops being harvested, HETP was used with some success under the conditions of the trial.

Broadcasting of metaldehyde bait and calcium cyanamide was highly effective in these tests, but rain reduced the period of effectiveness. The fertiliser may have a longer residual effect and allow band treatment for protection against migration from nearby weedy or trash-covered areas and may be better than metaldehyde baits spaced at intervals, but insufficient evidence was available on this point.

Heavy rain drastically reduced the residual effectiveness of treatments, but did not prevent their immediate effects, especially when applications were made when slugs were on the move.

Slugs are active throughout the year and are troublesome whenever temperature and moisture are favourable. Snails are usually dormant in hot dry periods and in winter.

Destruction of grass, weeds, and rubbish in which slugs and snails shelter is important in control. Crop residues, grass, and weeds should be ploughed in wherever practicable.

The Home Garden in April

By A. G. KENNELLY

SOWING and planting of vegetables in April should be limited, as temperatures and the strength and duration of sunshine are decreasing and even hardy vegetables will grow only slowly; but hardy plants such as cabbages and in most districts cauliflowers, silver beet, and lettuce should grow reasonably well if good plants are set out in well drained, well sited soils.

FROST can be expected in many districts in April, and the harvesting and storing of crops such as onions, shallots, cucumbers, pumpkins, marrows, and squash should be completed before damage is caused by low temperature or frost. Kumaras should not be stored at low temperatures, and frost may damage pumpkins, marrow, squash, and onions. Light frost is unlikely to affect the keeping quality, but heavy frost will.

In mild districts the pods of peas and dwarf and runner beans should be picked regularly before they are mature to encourage the plants to continue bearing. If more beans are available than are needed immediately, they can be preserved or held in a refrigerator.

Leeks should be earthed up as they develop if long blanched stems are wanted. Celery, too, should be blanched by being earthed up, by the use of suitable reinforced paper or boards along the sides of the beds, or by wrapping the stems of individual plants in paper.

In districts where soil conditions are favourable for overwintering a sowing of peas can be made toward the end of the month.

SOWING AND PLANTING

Sow	
Onions Spinach	Early in the month, in well drained soils that are not too cold
Carrots	A small sowing in districts where winter conditions are not too severe
Peas	In well drained, fertile soils in favourable situations toward the end of the month
Broad beans	An early sowing in most districts
Plant	
Cabbage Cauliflower Lettuce Silver beet	In most districts

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In some southern districts it is customary to make an early sowing of broad beans toward the end of the month, but early sowing is not necessarily an advantage. It depends on how exposed or sheltered the area is and how severe the winter is. Early sown beans that are checked by low temperatures or severe weather may crop later than later sown ones which grow steadily without check.

Autumn Sowing of Carrots

Where winter temperatures are not too low a sowing of carrots for early spring use may be made toward the end of March or in early April in milder districts. Excessively low temperatures are liable to make autumn-sown carrots bolt or go to seed when temperatures rise in spring.

Where drainage is poor a raised bed is advisable. For convenience in cultivating and harvesting the bed should not be more than about 3 ft wide. Seed should be sown thinly. Soil heavily manured for the previous crop is usually best and sandy or light loams are especially suitable for autumn-sown crops.

Apart from the need for a well cultivated, highly fertile soil, one reason for the lack of success with carrots is that seed does not germinate and the young seedlings do not grow well if the weather is hot and dry. The roots of established plants stand fairly high temperatures, but growth is usually better if temperatures are not high.

Potatoes should be dug when mature or soon after. If they are left in the ground, they are liable to injury from weather, insect pests, and diseases.

[*Orr*

Potatoes should be dug when they are mature, as they are likely to be damaged by weather, insect pests, and diseases if they are left in the ground.

Cutting Top Growth of Asparagus

The top growth of asparagus can be cut when the foliage begins to turn yellow. Cutting should not be deferred too long, as the seed may ripen and fall and the young plants which come up the following season may not be noticed and become established to the detriment of the bed. Fern growth can be cut with hedge shears which have notched blades, with secateurs, or with a sharp knife. The bed should be weeded afterward.

Celery

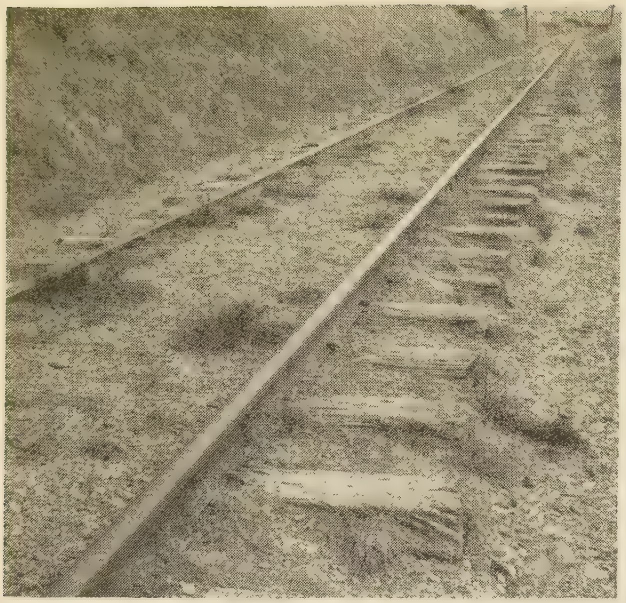
In districts where growth can still be expected self-blanching celery can usually be improved after the blanching material has been put in position by watering with sulphate of ammonia or nitrate of soda at about 1 oz to 2 gallons of water. This usually stimulates growth, causing elongation of the heart and leaf stems and improving the texture. Regular spraying of celery with a suitable fungicide such as captan, zineb, or copper oxychloride will control celery leaf spot disease, which spreads rapidly in the moist conditions usual in late autumn.

Rhubarb

Rhubarb should be kept free from weeds, and varieties for harvesting over autumn and winter usually benefit from a topdressing of animal manure or a complete fertiliser, which can be made up of 3 parts of sulphate of ammonia, 3 parts of superphosphate, and 1 part of muriate of potash (all by weight) worked in at 3 to 4 oz to the square yard.

Planting Cabbage for Spring Use

Cabbage for spring use can be set out in April or May or even later. Mid or late April is generally preferred, but an early and a late planting will spread maturity. If large plants are set out too early, they may make soft growth and be checked or even forced into premature seed development in winter.



ROUND THE RESEARCH STATIONS

Current Work and Findings in Department of Agriculture Trials and Experiments

Rukuhia

Weed Control on Railway Tracks

Keeping railway tracks free of weeds is the most expensive annual weed control operation in the country. Formerly tracks were weeded manually with hoes or, where possible, with horse-drawn scarifiers. The need for track maintenance labour to be used to better advantage during the Second World War speeded the introduction of chemical weedkillers for track weeding and during the past 15 years increasing use has been made of these materials with corresponding savings in man-hours spent on manual weeding.

While notable developments continue as the result of research work in selective weed control, much research is being directed also to new chemicals which are being developed for use on railway tracks and other areas where a total kill of all plant growth is necessary. The track testing of "total weedkillers" for merit under railway conditions is one of the more applied aspects of the Rukuhia Soil Research Station weed control research programme.

Though one chemical may prove better than others for the control of a specific type of weed infestation, its performance may be impaired when it is applied in a different manner, under adverse weather conditions, at the wrong growth stage, or to an infestation of resistant weeds. All chemicals used for weedkilling have particular limitations and disadvantages. Thus while older type weedkillers such as chlorates and chlorides gave satisfactory control of annuals and "soft" weeds on railway tracks, many species of perennial and grassy weeds proved resistant and became dominant along the formation.

Disadvantages of particular importance in railway weed control work which require investigation are the way the materials are affected by varying climatic conditions and types of ballast, problems of application, interference with train operation and signalling, and toxicity to operators. Cost, of course, is a major factor.

During the past season 1,500 miles, approximately half the total track milage in New Zealand, has been treated experimentally with new types of weedkillers such as dalapon and amitrol, which offer considerable advantages over older types of materials previously in use. This research has already provided results of considerable national economic importance, but is capable of further application to the weed problems of local bodies and of industrial and other areas where total weed control is the objective.

Wallaceville

Dogs Susceptible to Dieldrin

Over the last few years a considerable number of cases of suspected dieldrin poisoning in sheep dogs has been diagnosed and new cases are still occurring. Dogs are known to be very susceptible to this type of insecticide, and experimental work has shown that putting them through normal strength dips is enough to kill some dogs. Dieldrin is a cumulative poison and can be taken into the system by swallowing the dip or by absorption through the skin. It is therefore very important to keep the exposure of dogs to dieldrin type dips, sprays, or dusts to the minimum.

Ruakura

The Swedish Landrace

During the past 12 months studies at the Ruakura piggery have been concerned with the Swedish Landrace, with the aim of finding out whether or not it could successfully be used as a third breed in the present recommended crossbreeding programme.

Under standard conditions the breed has been undergoing a series of performance tests in which particular regard is paid to litter size, growth rate, the efficiency of food utilisation, and carcass quality.

Similar performance tests are also being made on crossbred progeny resulting from mating the Landrace to purebred Large Whites, purebred Berkshires, and the National Hybrid stock. In each case the performance of these progeny has been compared with that of progeny from mating purebred Large Whites and purebred Berkshires to National Hybrid sows respectively.

Results from these trials are being analysed to see whether by using the Landrace as a third breed in the crossbreeding programme the level of hybrid vigour in the commercial progeny of hybrid sows can be maintained at a high level with resulting benefits to litter numbers and litter weights.

Wallaceville

Exudative Diathesis and White Muscle Disease in Chickens

Exudative diathesis, which was at one time referred to as X disease or green leg, was shown by Wallaceville experiments some years ago to be one of the manifestations of vitamin E deficiency. Some relief was achieved by the use of wheat germ meal and vitamin E therapy. Its incidence is practically confined to the South Island or where South Island mashes and wheat are used.

During the past rearing season there have been many cases of this condition, even where wheat germ and vitamin E have been included in the diet. Spectacular results with selenium in controlling a similar condition in lambs in the same area led to the use of selenium for the control of exudative diathesis in the field with excellent results.

Selenium is a highly toxic element and the Selenium Control Regulations 1959 stipulate that it must be used only under the direction of a veterinary officer. The good results obtained have been achieved by the use of extremely small doses, and trials being conducted jointly by the Wallaceville Animal Research Station and the Poultry Demonstration Plant have shown that if this dose is exceeded, toxicity results.

The fact that white muscle disease has been seen in chickens at three days of age suggests that the breeding stock has been deficient and further work is being done to determine other factors such as the effect on fertility and hatchability.

Invermay

Winter Spelling of Pasture

Results of a preliminary investigation indicated that winter spelling of pasture had little effect on the time of onset of growth or amount of herbage produced in early spring. Plots spelled throughout the winter and trimmed during early August failed to produce more herbage in August and September than other plots which had been continually grazed throughout the winter and were trimmed at the same time. Though composition changes were slight, there was a tendency for the plots which had been spelled for a long period to be more open and have a lower clover content.

Wallaceville

Yearling Cattle Losses from Worms

The only positive finding during investigation of some very severe mortalities in yearling cattle in the winter of 1960 has been extremely heavy worm counts, which have persisted in spite of treatment with the available remedies. In addition to therapeutic measures consideration should be given to the provision of adequate shelter and the use of some supplementary feeding in the form of a meal or nuts. Where possible the adoption of the Ruakura method of rotating the calves in front of the dairy herd should be practised.

Calf in poor condition as a result of severe worm infestation.

Seasonal conditions in certain areas last autumn and winter favoured the development and survival of worm larvae.

◆

Care of Livestock during April

By Wallaceville and Ruakura Animal Research Stations

MANAGEMENT OF THE EWE FLOCK

SHEEP farmers should plan now for that feed critical period of the year, the last four to six weeks before lambing. Studies at Ruakura show that both lamb mortality and wool growth can be markedly affected by the way in which ewes are fed at this time. Poorly fed ewes may give birth to small twin lambs which in consequence have a low survival rate. In addition ewes treated in this way may clip from ½ to ¾ lb less wool. In contrast ewes very well fed tend to give birth to large single lambs which give rise to difficult births. Lamb losses are lowest in ewes given a moderate lift in the level of feeding.

The feed requirements of a ewe in late pregnancy are determined by her condition as well as by the number of lambs she carries. A ration providing sufficient feed for ewes in store condition is quite inadequate for ewes which are fat. Similarly feed sufficient for a ewe carrying a single lamb falls far short of the amount needed by one carrying twins.

Ruakura records show that by the end of the fourth week of tupping over 80 per cent of ewes are in lamb. Once they are in lamb it is important to restrict the feed intake of the ewes so that they lose some of the weight gained during flushing. This will serve to get them in a reasonable store condition during the next three months and so reduce their feed requirements in late winter. During this period of feed restriction, any overthin ewes should be periodically drafted off from the main mob and given preferential treatment.

WINTER FEED

The method of providing winter feed will depend on the type of farm and its locality. In districts with prolonged winters it is customary to grow crops such as chou moellier and/or swedes. On hill country it is usual to graze the flock on the easier, more accessible paddocks during mating. Once in lamb the ewes can be put further back on rougher country while the easier slopes are spelled to provide feed during lambing. On fat lamb farms from a third to a half of the farm should be closed to provide autumn-saved pasture for use in late winter.

SLEEPY SICKNESS IN EWES

This disease affects in-lamb ewes and is due to insufficient feed toward the end of pregnancy. Ewes whose feed requirements are relatively high are most commonly affected, that is, those in good condition carrying either twins or large, well developed singles. Control is based on preventing ewes from getting excessively fat in early pregnancy and using the feed saved to keep the flock on a gradually rising level of nutrition during the last four to six weeks before lambing.

CARE OF CALVES

The best way to prevent calves dying during winter is to treat them properly during autumn. They should never spend more than two or three days in one paddock and should be rotated ahead of the cows through the best paddocks available. Good hay should be provided for them daily, especially when the feed is growing fast after autumn rains. Set-stocked calves should be drenched with phenothiazine as soon as scouring is noticed.

DRYING OFF DAIRY COWS

A dairy cow requires a reasonable spell between lactations and should be dried off at least six weeks before she is due to calve. This should be done even if she is still milking heavily. The drying-off process need not be prolonged; it is quite safe just to stop milking, provided any quarters affected with mastitis are treated with the usual course of three tubes of penicillin, the last tube being given after the cow is milked for the last time.

PURCHASE OF HERD SIRE

If a new herd sire will be required this year, now is the time to make inquiries. The New Zealand Dairy Board issues a Sire Survey and Merit Register which gives the production of the daughters of all dairy sires which have been surveyed. Unfortunately very few progeny-tested sires are available, but the Register should be consulted and wherever possible a bull by a proven sire out of a merit cow should be selected. Bull catalogues are issued annually by the Herd Improvement Association, and these too should prove of considerable value to dairy farmers who are looking for herd sires.

DECEMBER-FARROWED PIGS

Litters farrowed in December should be sold as pork. If they are carried on to bacon weights, no milk will be available for the later litters, which will have to be sold cheaply as stores or wintered on expensive concentrates. Available root crops may be fed to sows, but they require supplementing with milk or meat meal. Crops of fodder beet quality or better may be used as part of the ration to fattening pigs.

CARE OF LAMBS

If the summer and autumn have been wet, lambs are likely to be suffering from worms. Drenching with fine-particle phenothiazine two or three times at monthly intervals will help. This applies particularly to the tail of the flock, which should be drafted off for special attention. Feed, however, is the most important consideration. During autumn lambs do best if grazed on pastures which have been allowed to grow to a height of 4 to 6 in. Hay aftermath and clover are very good. If these are not available, the lambs should be distributed thinly over the dairy paddocks or on hill pastures. They should on no account be concentrated in large numbers on short, rapidly growing pastures, especially if these have previously been grazed by ewes and lambs.

TUBERCULOSIS IN POULTRY

Though tuberculosis is uncommon in commercial poultry flocks, it is a disease quite frequently found in small farm flocks, where it may spread to pigs with consequent condemnations at meat works. If this disease is suspected, veterinary aid should be sought to eliminate affected birds.

Seasonal Notes

By Farm Advisory Division

SURFACE DRAINAGE

SURFACE drainage can be successfully used under a wide range of conditions. Generally the practice consists of a system of land preparation rather than a series of isolated drains; thus surface smoothing alone could be considered a method of drainage.

As the main object of the system is to aid run-off of surface water, one of the first requirements is a surface that is as smooth as possible. Where this is obtained puddle formation is kept to a minimum.

Where surface falls are limited and because of this an even graded surface is difficult to obtain, the old English ridge and hollow system can be used. The flat paddock is ploughed in 10 yd lands and the feerings are graded up with a road grader or tractor-mounted grader blade. This gives the effect of a series of corrugations, and water is shed from the ridges into the hollows, whence it runs to the main drains. These hollows may tend to lie wet and grow rushes, but can be easily cleaned and reformed with one of the new spinner drain diggers.

Graded surface channels may be used to intercept run-off on rolling country. These channels may be formed by a plough and grader blade, a spinner, or a bulldozer, and when the objective is drainage, grades should be fairly steep, possibly up to 1 in 20.

—*D. F. SCOTT, Auckland*

* * *

SOWING TEMPORARY PASTURES FOR HIGH YIELDING HAY CROPS PLUS WINTER GRAZING

How much easier it is to cut well over 100 bales per acre of excellent hay from a special-purpose pasture than be forced to cut a much larger area of inferior permanent pasture to get enough bales for your supplementary feeding requirements. A special pasture mixture will also provide good out-of-season grazing over a longer period.

A recommended special-purpose mixture is 10 lb of Italian ryegrass, 5 lb of perennial ryegrass, and 5 lb of cowgrass per acre. Favourably situated high fertility districts may use short-rotation ryegrass in place of Italian ryegrass, but if summer drought or frosts are likely, the Italian ryegrass should be used. Such a mixture can be sown after a summer crop such as soft turnips has been fed off or directly after cultivating a poor, run-out sward badly in need of renewal.

A liberal topdressing of superphosphate in line with district practice is advisable and the mixture is suitable for both sheep and dairy units. Sheep farmers can use the area for high-quality grazing right up to the time of closing for the hay crop, the aftermath also giving good grazing, or two crops of hay can often be taken. On dairy farms the area may be closed for silage after the winter grazing and a hay crop taken too. The area should be subsequently leniently grazed before it is closed for autumn. Top production will be obtained for two seasons, and the area can then be converted to a more permanent sward by the introduction of other species or resown.

—*R. W. MOODY, Rotorua*

* * *

NODDING THISTLE CONTROL

SEEDS of nodding thistle (*Carduus nutans*) strike readily in autumn, a strong root system is established over winter, and by spring the young thistle is already smothering a rapidly increasing area of pasture.

The seedling thistle is highly susceptible to light rates of hormone weedkiller; satisfactory control can be obtained by spray application of ½ lb acid equivalent of the potassium salt of MCPA, the sodium salt of MCPB, or the amine salt of 2,4-D in April or early May. MCPB should be used if there is young clover in the pasture.

Lucerne should be sprayed with the sodium salt of 2,4-DB, as damage to the lucerne from any other weedkiller is too severe.

Results from spraying in winter are disappointing, but good control can be obtained by treatment in early spring. As the thistle matures heavier rates are needed.

—*E. DELAHUNTY, Ashburton*

* * *

HARVESTING MONTGOMERY RED CLOVER SEED

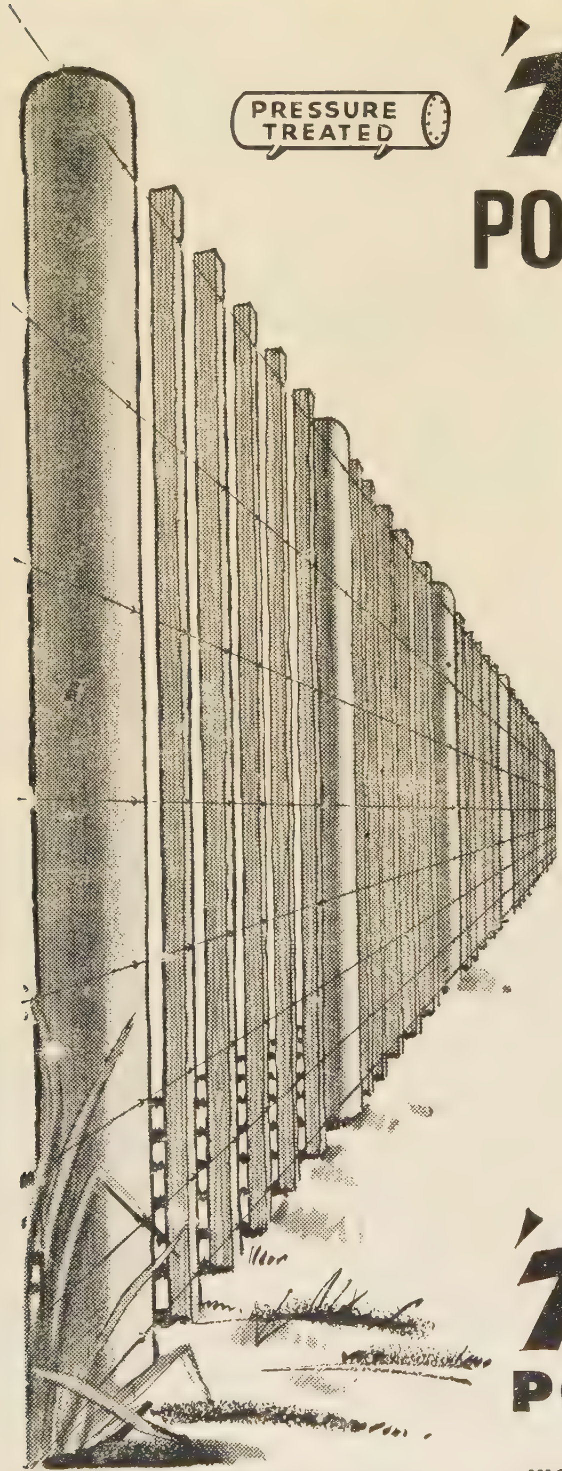
THIS crop is usually direct headed during late autumn, though harvesting can extend into winter. Usually in dry years second growth is not a problem and the crop is easily harvested. In wet years second growth can cause harvesting difficulties, and heavy frosts are needed to cut back leaf growth.

Normally heading should start when both stalk and seed head are fit and should be done only during sunny weather when dew is off the crop. At this stage wind can be disastrous in blowing the mature seed pods off the stalk. If the crop is going through the header easily and with good results, continue heading, but if there is any difficulty wait until the crop is more mature.

Using crop desiccants on areas with large amounts of second growth will ensure easier harvesting and rapid maturity of the seed heads. Harvesting can be done within a few days of application of a desiccant and it allows a longer heading day.

Correct header settings are essential to obtain sound seed. Usually damaged seed is caused by high drum speeds, too fine riddle settings, or too close setting between drum and concave. Another frequent cause of damage to seed is threshing the crop when it is out of condition.

—*R. K. DARWIN, Dunedin*



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Yarrow as a Weed and Seed Crop

ON arable land yarrow is normally regarded as a troublesome weed. On hill and high country pastures it was used because of its palatability and soil binding attributes, but this is now discouraged. As a lawn grass it forms a dense, hard-wearing mat surface. In this article D. G. Reynolds, Farm Advisory Officer, Department of Agriculture, Fairlie, discusses how yarrow can be eradicated from cultivated ground and how it should be handled when a seed crop is taken from an existing stand.

Yarrow as a Weed

YARROW grows under a wide range of climatic and soil fertility conditions. This adaptability is due to the "twitchy" nature of the plant; its strong, mat-forming system of fleshy, rhizomatous roots can withstand normal cultivation and severe drought. Moreover, it may be classified as one of the few high fertility twitches, since it is not deterred by vigorous competition from other species that flourish on highly fertile soils. This is especially so in the lower-rainfall areas.

Yarrow is extremely palatable to stock, but withstands prolonged and severe grazing. It seeds freely and the extremely small, light seed is easily spread for short distances by winds or may be widely distributed in sheep's wool.

In cropping land yarrow, in common with other twitches, is very troublesome. Once established, it can be very readily spread, especially by poor cultivation which breaks up the clumpy root system and scatters the pieces over a wide area; each piece of root is capable of establishing a new colony of the plant.

Control Measures

Yarrow is difficult to eradicate. The hormone weedkillers provide some measure of control. The recommended treatment is for a first spraying with esters of 2,4-D at 2 lb acid equivalent per acre applied at flower head initiation, followed by one or more repeat treatments when any regrowth has fully developed.

On arable land good control may be expected by a combination of thorough cultivation and grazing. Roots exposed by cultivation are avidly eaten by stock, especially sheep, which will even "dig" for roots in loose soil. A mob of wethers is probably best suited to this purpose. In pastures older than four to five years the rooting system of yarrow is not usually very deep and care should be taken to avoid ploughing any deeper than is necessary.

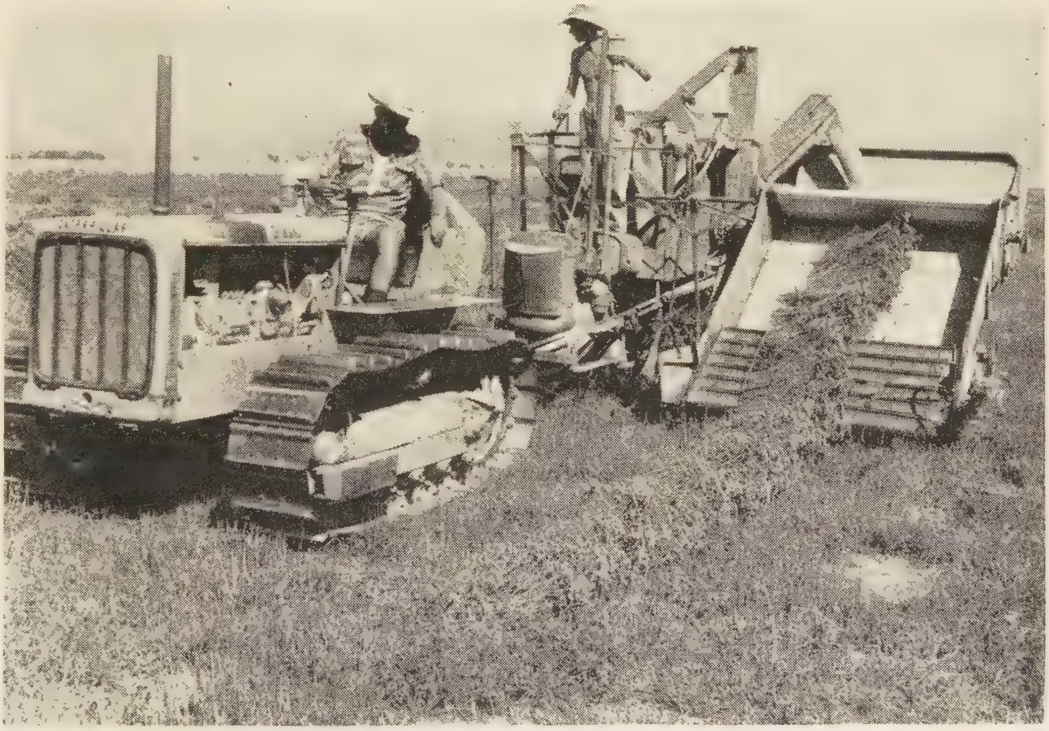
Early autumn ploughing followed by cross grubbing and fallowing usually leaves the sod in large chunks which dry out readily and can be easily broken down for grazing. Subsequently, a dense smother of autumn-sown cereal green feed followed by further cultivation and grazing should kill 95 per cent of the infestation. Any yarrow that recurs when the field is resown to pasture should be spot sprayed with hormone weedkiller.

Uses for Yarrow

Though the usefulness of yarrow in New Zealand appears very limited, it is favoured for lawns and playing areas that are subject to heavy wear. Its solid, mat-forming root system and fine feathery foliage provide a dense, even, and drought-resistant turf that requires very little cutting. For turf it is somewhat slow establishing, but is well worth perserverance.

For agriculture the use of this species is not now greatly encouraged. Though palatable and a good sheep feed, it is very low producing and under modern farming techniques and practices its presence hinders successful establishment of plants of better potential.

In the early days a few ounces of yarrow seed was often included in hill



When yarrow is → produced for seed the use of a crawler tractor allows a slow, smooth speed which does not shake the extremely delicate swath. The use of pea fingers rather than the pick-up would be an advantage.

YARROW . . .

country bush burn mixtures, especially in the steeper and dry hill country, and until fairly recently it has been used in the drier inland tussock areas of the South Island and has become firmly established.

Now improved cultural practices have been devised and better knowledge has been acquired of the soil nutrient deficiencies of the areas, thus permitting the use of more productive pasture species on country that formerly offered little opportunity for improvement. Yarrow is considered a serious weed and its sowing is discouraged except on the poorest of high hill country.

Seed Production

Despite its limitations in agriculture, yarrow is useful in other fields and there is still a demand for its seed. Many farmers have been tempted by high seed prices to try to save seed from existing stands, often with indifferent results.

Yarrow ripens its seed very unevenly and the seed shakes as soon as it is ripe. In wet climates and damp seasons little success can be expected. Ideal seed ripening and harvesting conditions occur in an early season when the seed ripens more evenly and quickly and the crop is rapidly desiccated by high temperatures. These conditions bring the maximum amount—about 70 per cent—of the seed to maturity at the one time.

A further 10 to 20 per cent increase in seed yield can often be attained by mowing just before the stage of maximum ripening or by mowing just after the initial heads are fully ripe.

Mowing and windrowing are the critical stages of the harvest. When yarrow is being mown, 4 to 5 in. of stubble should be left so that the swath lying on top of the stubble can be fully ventilated for rapid drying.

The seed heads should be kept uppermost as far as possible; otherwise much of the seed is shed. The high stubble also helps to serve this purpose by allowing the cut stems to fall down between the standing stalks. The swath should also be laid away from the prevailing wind; otherwise the seed is likely to be blown out. Depending on temperature and humidity, the cut crop should be ready for heading in from five to seven days.

Once ready for picking up and threshing with the header the seed in the swath is very sensitive to the slightest movement. Consequently, in heading, the tractor speed should be kept as slow and even as possible. A large swath, though slower drying, is less sensitive to movement by wind or the movement of harvesting equipment than a thin swath.

The amount of threshing required is probably less than for any other seed crop and since the seed of yarrow is so small and light, the draught applied must be light. It is better to bag up a relatively large proportion of crushed seed heads and dust than blow half the seed out of the rear of the header as so readily occurs unless the draught is carefully regulated.

Seed yields per acre show very considerable variations, but 180 lb would be considered good.

In the selection and preparation of an area for seed production the best field to choose is one where yarrow is densely established, a factor that is normally influenced by the age of the stand; the longer yarrow has been established on the area the denser the stand is likely to be.

Prospects for satisfactory seed yields can be improved by harrowing the field in autumn and topdressing with superphosphate. This encourages good growth and flowering in the following season. Subsequent grazing of the area should be very light and confined to early spring. As yarrow matures relatively early in the season, any grazing in late spring will diminish the number of seed heads formed. The denser the crop the better are the chances of saving seed.

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Dairy Produce Graded for Export

THE following figures showing quantities of dairy produce graded for export during December 1960 and for the five months ended 31 December 1960 with comparative figures for the same month and the five months of 1959 have been compiled by the Dairy Division of the Department of Agriculture from figures supplied by divisional officers at the various grading ports:

BUTTER

Period	Creamery (tons)	Whey (tons)	Total (tons)	Percentage Increase
December 1960	23,833	411	24,244	—
December 1959	23,678	450	24,128	—
Increase or decrease	+155	—39	+116	+0.481
5 months ended 31/12/60	103,524	1,777	105,301	—
5 months ended 31/12/59	100,361	1,724	102,085	—
Increase	+3,163	+53	+3,216	+3.150

Butter in store at 31 December 1960 was 35,352 tons

CHEESE

Period	White (tons)	Coloured (tons)	Total (tons)	Percentage Inc. or dec.
December 1960	13,058	340	13,398	—
December 1959	12,985	1,235	14,220	—
Increase or decrease	+73	—895	—822	—5.781
5 months ended 31/12/60	44,571	6,058	50,629	—
5 months ended 31/12/59	43,650	6,153	49,803	—
Increase or decrease	+921	—95	+826	+1.658

Cheese in store at 31 December 1960 was 20,926 tons

If these figures are converted into butterfat equivalent, there is an increase of 2.881 per cent in butterfat graded for the five months as compared with the preceding season. The above figures refer only to butter and cheese graded for export and do not include butter and cheese used on the local market and other products such as anhydrous milk fat, whole milk powder, and other whole milk products, and are not necessarily a true indication of production trends.

Meteorological Records for January

Station	Height of station above M.S.L. (ft)	Air temperatures in degrees (Fahrenheit)				Rainfall in inches					Bright sunshine hours
		Approx. mean	Difference from normal	Absolute maximum and minimum		Total fall	No. of days of rain	Difference from normal	Maximum fall		
				Maximum	Minimum				Amount	Date	
Kerikeri	240	65.5	+0.6	81.5	49.9	4.50	11	+0.0	0.78	21	187
Auckland	160	66.2	—0.2	78.8	55.3	5.12	9	+1.8	1.83	16	186
Tauranga	12	65.7	+1.1	89.4	48.3	6.88	14	+3.4	1.64	16	199
Ruakura	131	64.6	+1.5	80.1	44.8	4.92	11	+1.6	2.21	22	200
Whakarewarewa ..	1,006	63.0	+0.4	86.2	39.1	4.51	15	—0.3	1.11	22	204
Gisborne	12	63.4	—1.4	87.9	45.0	9.16	16	+6.4	4.56	16	166
New Plymouth ..	160	65.0	+2.8	79.8	48.0	4.55	9	—0.1	1.84	19	210
Karioi	2,125	59.0	+2.0	80.0	34.3	7.94	12	+4.1	2.88	22	—
Napier	5	63.8	—1.7	88.0	46.5	4.25	12	+1.6	1.76	16	184
Wanganui	72	64.6	+1.1	82.4	46.2	5.09	11	+2.4	2.58	19	206
Palmerston North ..	110	63.6	+1.2	83.5	40.1	6.76	12	+2.1	3.21	20	168
Waingawa	340	61.2	—1.2	84.0	39.0	7.96	14	+5.5	3.05	20	193
Wellington	415	61.6	+0.6	80.5	47.3	3.91	12	+1.0	1.95	20	239
Nelson airfield ..	5	63.6	+2.0	85.4	44.7	5.72	10	+3.0	3.03	17	245
Blenheim	14	62.8	+0.2	90.4	43.3	5.00	5	+3.0	2.35	16	226
Hokitika South ..	15	61.0	+2.9	76.5	40.3	3.23	14	—6.6	0.70	29	202
Hanmer Forest ..	1,270	58.6	—1.1	90.9	38.0	5.43	13	+1.9	1.57	20	174
Christchurch ..	22	60.8	—0.6	87.7	42.7	3.52	11	+1.3	1.30	17	166
Ashburton	323	61.9	+0.9	94.3	40.5	4.18	11	+1.9	2.20	19	159
Timaru	56	61.0	+0.4	91.1	39.1	4.34	11	+1.8	1.02	19	141
Alexandra	520	62.7	+1.0	89.0	40.0	1.30	6	—0.3	0.47	19	219
Taieri	80	58.0	+0.2	87.9	37.0	2.25	9	—0.6	0.92	19	165
Invercargill airfield ..	0	56.8	+0.6	79.2	33.3	2.39	12	—1.2	0.95	10	156
Chatham Island ..	150	55.8	—1.5	68.4	43.0	2.71	18	—0.1	1.00	12	—

The development of New Zealand's all important livestock industry, which sustains our high standard of living, owes much to . . .

. . . The Working Dog . . .

[*Sparrow*

. . . His value is such that he deserves the little extra effort needed to provide adequately for his care and comfort. Such attention will be amply repaid by a longer and more useful life, often an extra four to five years.

Breeding

AS with other animals, selective and controlled mating for desirable characteristics is important in the breeding of worth-while dogs. A high degree of intelligence for several generations in both sire and dam is desirable to perpetuate these qualities. Obviously a dog with good ancestry is more likely to inherit ability.

Care of Brood Bitch

After the bitch is eight to 10 months old, she will have her first oestrus (heat), which normally occurs after this about every six months. It may, however, occur only once every 12 months. This condition is clearly indicated by increased attention paid to her by males and a reddish discharge from the vagina. As soon as this discharge ceases she is ready to mate. Provided the bitch is well grown, no harm will be done if she is covered at the first heat. The rearing of only a small litter should be expected of her at this stage.

To control breeding and to retain the working efficiency of males, bitches on heat should be shut away for three weeks immediately the first signs occur. A shed that can be locked or an inaccessible loft is ideal. As it is possible for more than one dog to father pups in the same litter, the bitch should be segregated until the heat period is finished.

Both parents should be healthy and free from worms and skin diseases. A pregnant bitch should be given gentle but regular exercise. An ample supply of clean fresh water should always be available, as she is often very thirsty during pregnancy.

Whelping often occurs under such unfavourable conditions that it is a marvel that the pups survive. Under natural conditions the bitch will select a dark, dry, sheltered spot and, unaided, whelp safely. However, if such freedom cannot be granted, she can be chained. The pups may arrive at intervals of 15 minutes or whelping may last up to six hours.

The odd one or two weakling pups are best destroyed unless their value is above average. Some of the smaller pups in a first litter may have difficulty in suckling if the mother's nipples are retracted, though the stronger pups can usually draw them out.

By L. P. WELLS,
Livestock Instructor,
Department of Agriculture,
Morrinsville

If all the litter die, the mother's milk will cause some discomfort for a time before she dries off, but this is a natural process, and no harm is done nor is human assistance necessary.

Handling of the pups frequently upsets the bitch and should be avoided until the pups are 10 to 15 days old and their eyes are open. The removal with a sharp pair of scissors of the dew claws will most likely be the first time it is necessary to handle the pups. This simple operation is best carried out at the earliest possible age.

Independent feeding may begin after two or three weeks, with warm, fresh whole milk at first. This may soon be followed with skim milk, which can be increased in quantity and then supplemented by soaking dog biscuits or bread and finely cut meat.

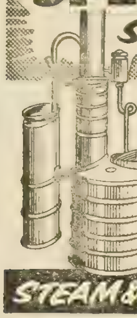
Weaning

If the pups are feeding and drinking readily, they can be weaned at six weeks. Three feeds a day should be given for the first two weeks after weaning. From then on twice a day will suffice. Weaning should be gradual. Avoid hunger that causes the pups to gobble their meals, because fermentation followed by diarrhoea is a common result. Properly fed pups are seldom ill. Plenty of exercise should be given to young growing dogs. Pups reared on the chain tend to become flat footed. However, as some restraint is necessary, they should, at four months of age, become accustomed to the chain and to being led about.

Training Period

Well bred pups show a desire to work sheep too early for their good. Training should generally begin when the pups are fast enough to head sheep or cattle. This may be six months or even up to 13 months of age.

Young dogs when not working should be restrained on the chain, in a pen, or under the care of the owner. Their work should be adjusted to prevent overtiring or loss of keenness. Keen young dogs when not at work or under observation may seek sheep and develop bad habits that are difficult to break.



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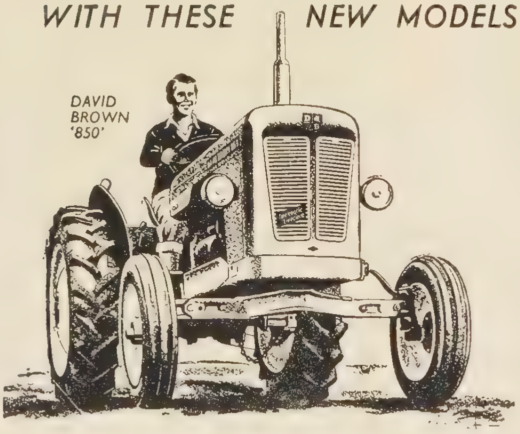

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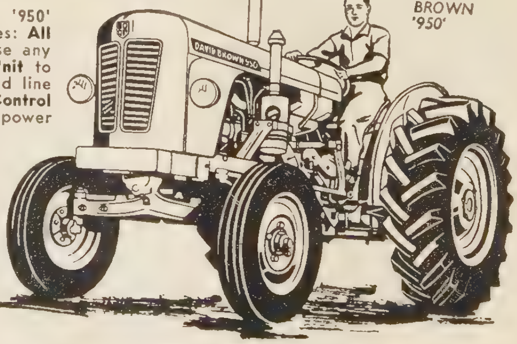

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Care of Adult Dogs

Mistakes are common in feeding working dogs. The idea that a working dog need not be fed for two or three days if not working is one that cannot be too strongly deplored. His anatomy and physiology do not enable him to store quantities of food as the cloven-footed animal does. A full ration must be provided during work, with a light but regular diet when idle.

Once a day feeding is a common and sound practice. Regularity of feeding is essential. The natural diet of meat and bones is the best for a dog. Where only one or two dogs are kept a little meat and household scraps are generally sufficient. When working, a dog requires about 1½ to 2 lb of meat daily or when idle about 1 lb. Sufficient to maintain condition is, however, the best guide.

Fish bones or similar bones should not be fed, as these may not be broken sufficiently by chewing to be digested and a blocked intestine can occur. If a number of dogs are kept and meat is not readily available, a mixture of fresh meat meal with cooked potatoes or pollard can be used as a substitute.

The offal of slaughtered animals can be fed provided it is properly boiled. Several types of oil burning and electric cookers that are marketed are efficient, cheap, and easily operated. By cooking this offal, not only is the law being complied with, but the intermediate stage of several types of tapeworm that infest the dog is destroyed.

Faulty feeding often causes diarrhoea or constipation. Diarrhoea is best treated by starving the dog until its stomach is empty, then giving ½ fl. oz. of paraffin oil, and then gradually returning to a natural diet of meat. Paraffin or olive oil is also effective for treating constipation.

COMMON AILMENTS

Distemper

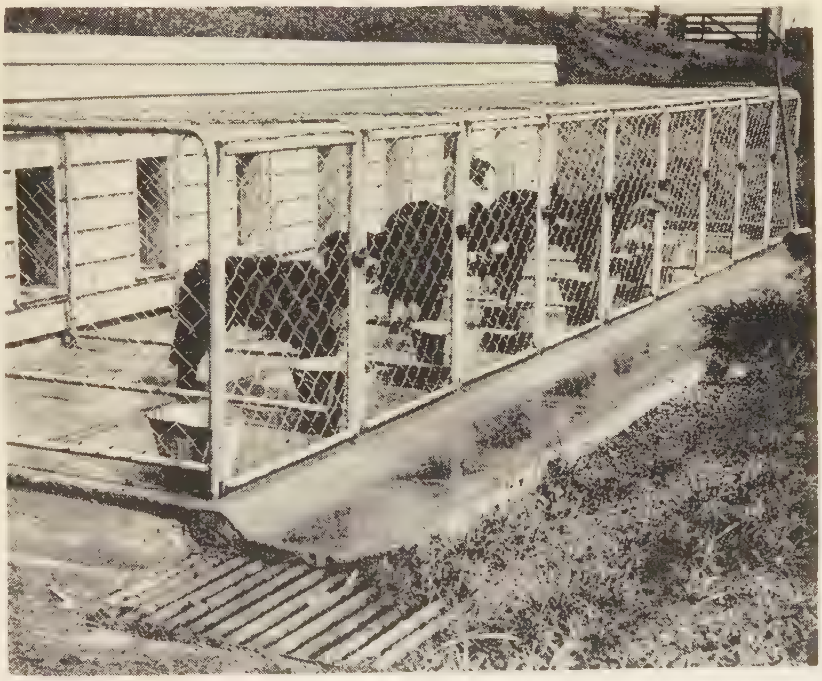
Distemper and its associate diseases and complications cause death, disablement, of destruction of more dogs probably than all other conditions. Distemper occurs in all parts of New Zealand and in all countries of the world and is caused by a virus of more than one strain.

Prevention by vaccination is the best treatment. Pups should be immunised against it when about three to four months old. Older dogs can be immunised, but the older the dog is the more likely it is to have come in contact with the disease and developed its own immunity.

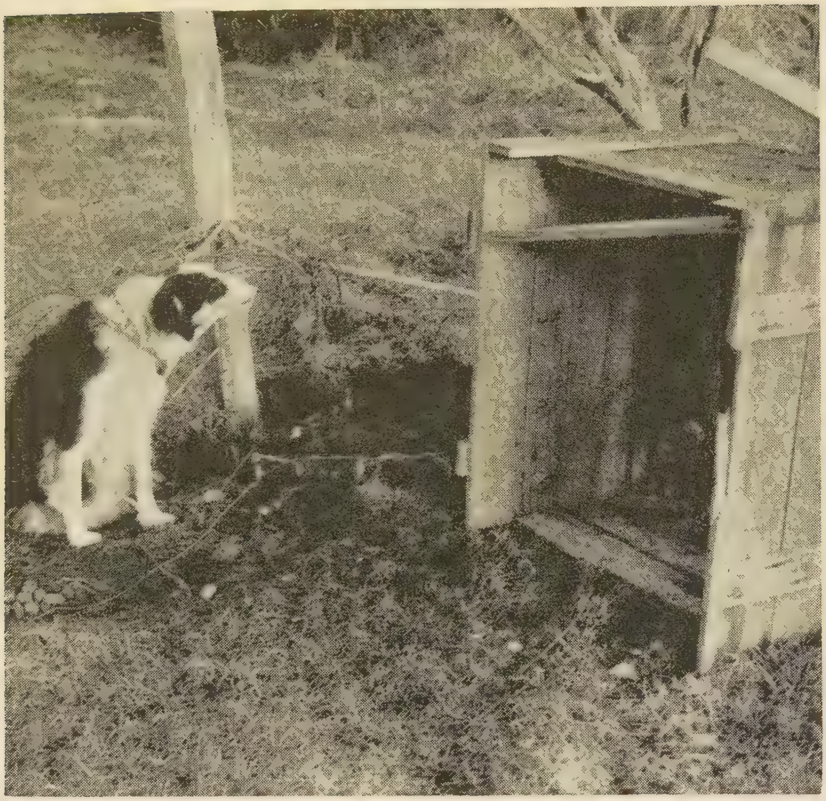
Both vaccination and treatment of the dog for this disease should be done by a veterinarian.

A SHARP CONTRAST

A short, miserable life can be the only expectation of the working dog shown above, its shelter a tree. The attention given the dogs below is well repaid by a longer and more useful life. The kennel is practicable and neat and provides dry, draught-proof housing. Water is laid on for cleaning and fresh water is available to the dogs at all times.



POOR TYPE OF DOG HOUSING



Typical of poor dog shelter on some farms. Such a kennel is sub-standard in every way, even to the extent of forcing the dog to remain cramped while sheltering.

Worm Infestations

Worm infestations in dogs can cause serious illness or even death of young dogs or pups. Older dogs can also be affected and become sluggish and inefficient. Round worms are the most likely to cause trouble, but hook worms may cause even more serious trouble.

Tapeworms, though not so damaging to the dog, are most important, because one of these causes hydatid disease in man and stock, and two other tapeworms cause cysts that are responsible for the condemnation at our freezing works of meat worth thousands of pounds a year.

With hydatid eradication schemes operating and frequent dosing of dogs with arecoline there should be little need for further drenching to control tapeworm infestations.

Round worm infestations, however, present another problem. Owners of dogs may carry out a great number of futile "dewormings" if effective drugs are not used or if the correct dose is not given.

Owners are therefore advised to seek veterinary advice or to assess the correct dose accurately.

Young animals are mainly troubled with round worms. Puppies may be affected with some shortly after birth. The dog host may be very seriously affected by the migration of the worms through the lungs and liver. Worms in the intestines may be so tightly packed that they wind together to cause obstructions. Affected animals may be anaemic, emaciated, pot-bellied, have harsh coats, and show diarrhoea, nervous symptoms, and convulsions.

Tetrachlorethylene in gelatine capsules at a dose rate of 0.1 c.c. for every pound of the dog's body weight may be given (a dog weighing 20 lb would receive 2 c.c.).

The dogs should be starved overnight and the drug given on an empty stomach. After it is weighed the dose should be put into gelatine capsules. These capsules should be placed one at a time as far back on the tongue as possible. A small dose of water given by making a pouch with the loose skin at the side of the mouth will ensure that the capsules are swallowed.

Piperazine given in the food at the rate of 1 gramme for every 10 lb of body weight is also effective.

Prevention is important and young dogs and pregnant bitches should be kept in clean quarters, free of infection, and their health maintained by proper feeding if this parasite is to be controlled.

Ring Worm

Ring worm is quite common in dogs and is caused by infection by fungi, which can be transmitted to man. On dogs the symptoms are generally bare, crusty, roughly circular patches on the head or limbs. Sometimes, however, ring worm spreads rapidly over the entire head and body.

It should be treated immediately. The hair round the infected area should be clipped and the area treated with tincture of iodine after being scrubbed with a wash of cetavlon at 1 : 200. All bedding should be cleansed and changed.

Fleas and Lice

Fleas and lice are common in dogs and are easily controlled by either bathing or dusting. The bath solution can be made by mixing benzene hexachloride at 1 part to about 1,000 parts of water. Dusting is simpler and powders containing benzene hexachloride or DDT are ideal. The place where the dog normally lies or sleeps should also be treated, as fleas and lice live in dust. Because carbolic solutions severely irritate a dog's skin, these should not be used. Dieldrin or aldrin insecticides are not recommended, as they may be absorbed through the skin and be poisonous to the dog.

Housing

Dog housing should be easily cleaned and combine neatness with practicability. If not permanently sited on concrete, it should be readily movable to a clean area. It should not be so small that the dog is forced to remain cramped while sheltering.

The kennel must be draught proof. A permanent structure built on an impervious floor with a pen adjoining that can be regularly washed down is ideal. The kennel should be on a warm spot lying away from the prevailing wind.

General Care

Dogs that are confined in pens or are on the chain should be exercised daily. Fresh water should always be available. Dogs are too often allowed to suffer from thirst in hot weather.

A dog chained away from its kennel should be placed so that it cannot jump over or through a fence or rails and so hang itself. Many a good young animal has been lost in this way. Chaining of a dog to a car or truck is also unwise.

MOLE DRAINAGE ON PEAT

LOW COST, EASILY CONSTRUCTED MOLE PLOUGH PROVES INVALUABLE ON WAIKATO PEAT FARM

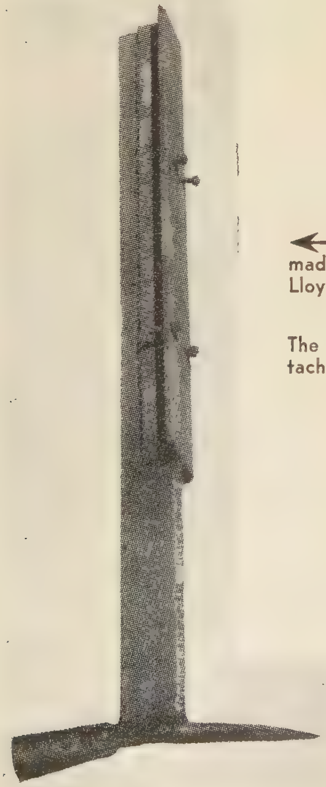
By P. F. GOULDING,
formerly Fields Instructor,
Department of Agriculture,
Hamilton

A CHEAP, effective, and very easily made tractor-mounted mole plough has been designed and constructed by Mr Lloyd McKain, Ngahinapouri. He farms a 150-acre dairy unit, mostly peat, on which he milks 100 cows and carries 142 head of stock through the winter.

UNTIL recently Mr McKain was most concerned about the extremely wet conditions on much of his property in the winter. At the suggestion of the Department of Agriculture he decided to try mole ploughing one of the wettest paddocks at the back of the farm. This he did with immediate success and says that he could "literally hear water being sucked behind the plug".

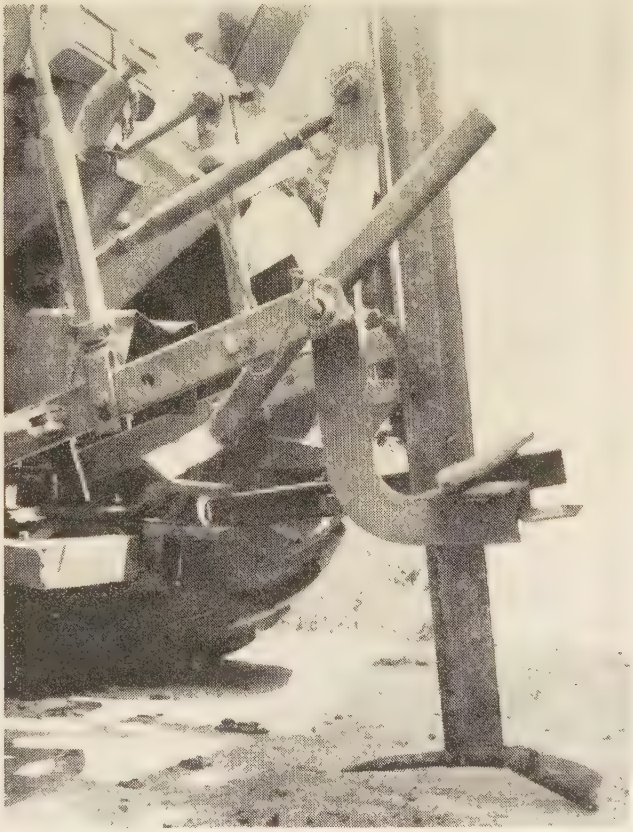
Mr McKain intended to buy a mole plough for the job, but when he discovered the implement would cost £47 he decided that he could make one for considerably less by using his farm welding plant. He cut a 16 in. knife edge on one side of a 4 ft length of ½ in. steel 4 in. wide. Then he welded two 32 in. lengths of 2 in. angle iron on either side of the blade to form a flange above the knife, and bored four bolt holes, two in each side, to attach the mole plough to the hydraulically operated mower frame worked on the tractor's three-point linkage.

For the point of the plough he cut the end off a broken buckrake tine and bent it slightly downward. This was found to be necessary to counteract the tendency for the tip to rise



← Blade of the home-made mole plough on Mr Lloyd McKain's farm at Ngahinapouri.

The mole plough attached to three-point linkage of tractor. →

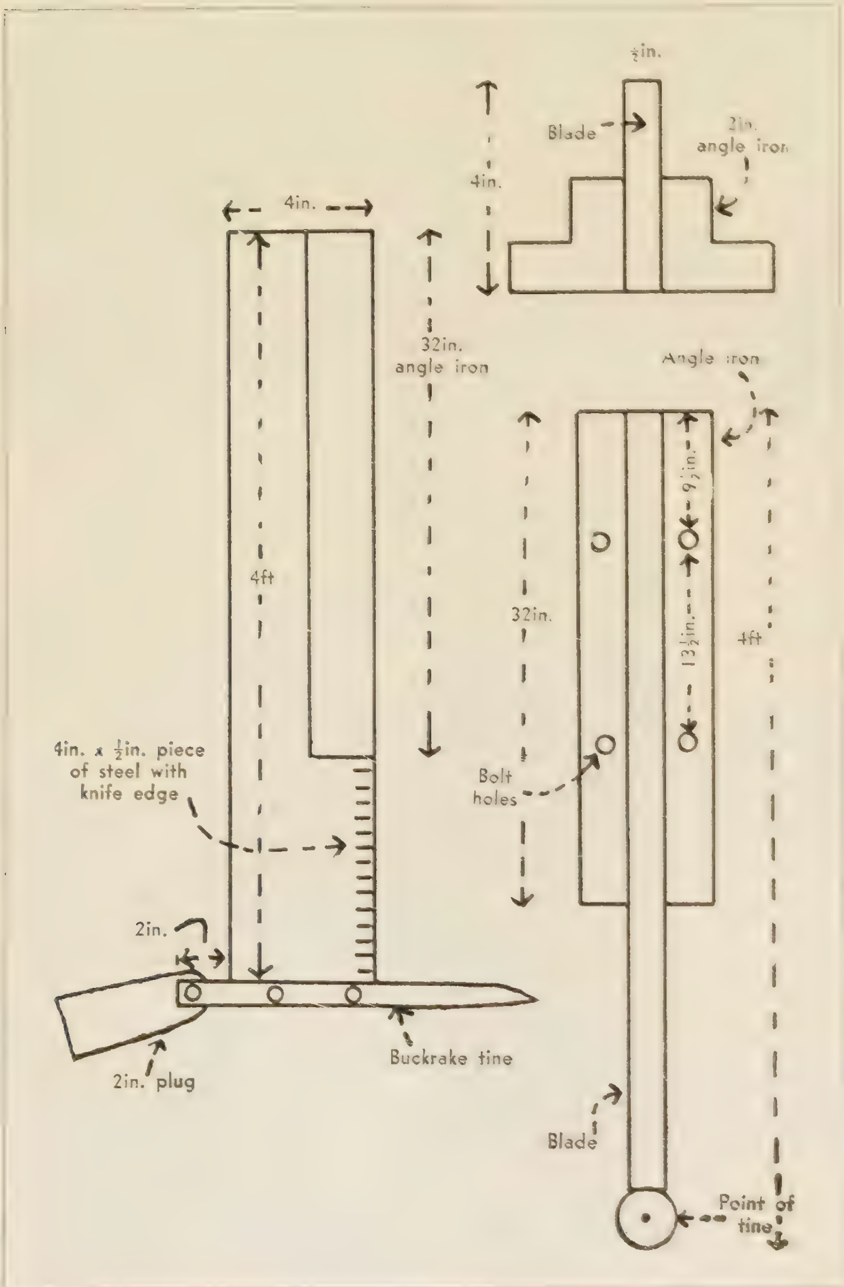


when travelling through the soil. He then cut a slot 6 in. long into the butt of the tine and bolted, riveted, and finally welded the tine into position at the bottom of the blade, leaving a 2 in. projection to which the 2 in. mole plug was bolted. The plug, incidentally, was the only item that had to be bought.

Care with Tractor

The plough is pulled by a 53 h.p. diesel tractor, but Mr McKain believes a medium size tractor would handle it quite easily. When operating it he engages the lowest gear and lets the tractor creep. He emphasises the importance of this, because of the frequent underground obstructions. Extreme care has to be taken not to make sharp bends. Turns should be anticipated and slow curves must be made in preference to sharp turns which bend the blade.

The method followed by Mr McKain is to insert the plough to a depth of 16 in. at the outlet drain and then to pull moles across the field at a spacing of 6 yd. Water runs through the channels as soon as they are drawn and the outlets usually gush water for the rest of the winter.



One of the first fields to be mole drained was cut for hay last summer. A baler was hired to assist with the harvesting and motor trucks were used to pick up the bales from the paddock. It was considered certain that all this heavy traffic would collapse the channels, but surprisingly the drains continued to work just as well again this winter.

A good example of the ground fall is a field of two-year-old pasture in which particular care was taken over the mole draining. A "dumpy" level was not available, so sights were taken with a standard builder's level which indicated the fall to be 1 ft in 220 ft or a little less. This field, though fairly well stocked, remained dry practically the whole winter in spite of the extremely wet season.

Where the fall is considered insufficient the plough is inserted into the ground to the normal operating depth of 16 in. to begin with and is gradually raised during the run by slightly raising the lever which controls the hydraulics. Under these circumstances it can be raised with safety 3, 4, or even 5 in. from start to finish. However, practice is needed, as the common error, until one gets experience, is to raise the mole plough too much.

A Complete Success

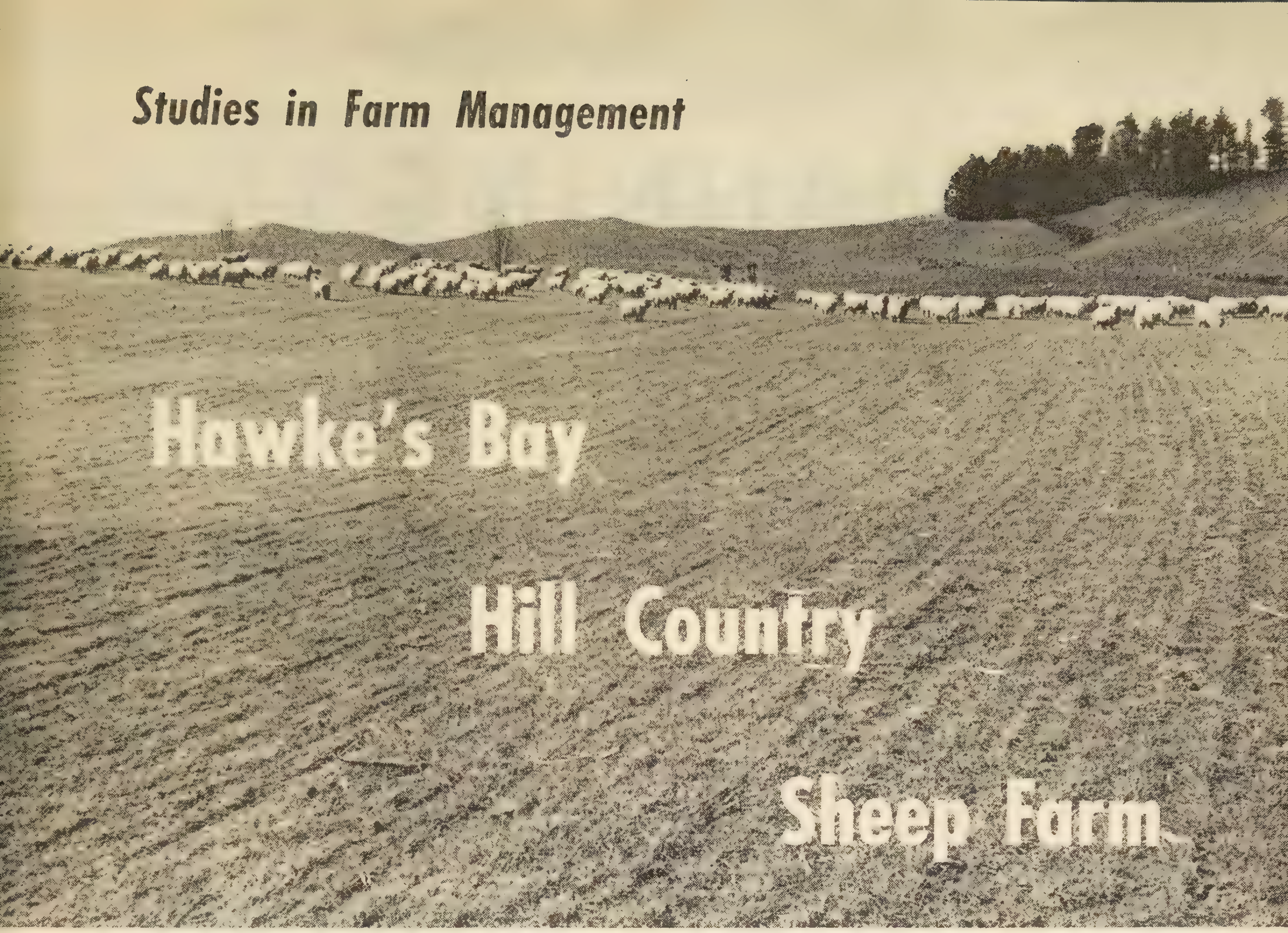
Mr McKain is now convinced that mole draining is a complete success on his farm. It has eliminated the necessity to continue forming surface drains which were a nuisance at harvest time. In addition, cows no longer make holes near the V drains in the winter by persistently walking or jumping across them at chosen points.

Experience has shown on this peat farm that the best time to mole plough is in the autumn. Moling at this time of the year, however, would apply only to peat soils. The best traction is obtained immediately after the fields have been fed off and before they are shut up for autumn saved pasture.

Approximate Costs

	£	s.	d.
Mole plug (2 in.)	2	0	0
Blade	1	0	0
Broken buckrake tine (say)		5	0
Angle iron		15	0
Bolts and rivets		10	0
Labour (say 4 hours @ £1 per hour)	4	0	0
	8	10	0

Studies in Farm Management



Hawke's Bay Hill Country Sheep Farm

▲ New pasture being grazed off with hoggets.

THE western hill country of central Hawke's Bay, known locally as the Western Foothills, has received increasing attention in recent years from the land improver. A considerable part was in fern and scrub and poor pastures, but resubdivision, resowing, topdressing, and better stock and pasture management have effected a marked change. Formerly a store stock district, it now produces considerable numbers of fat lambs and chiller beef cattle, and through good farm management, rotational or systematic grazing, and good pasture maintenance has increased stock production in recent years more than any other area in Hawke's Bay. This article discusses in detail the improvement methods used on a farm typical of this area, that of Mr A. M. McNeill at Otamauri about 27 miles north-west of Hastings.

By F. H. COLLIN,
Instructor in Agriculture,
Department of Agriculture,
Hastings

DURING the 13 years since he bought the property this farmer by effective planning, excellent rearing and handling of stock, and sound pasture management has had very good results. The total area of the farm is 1,254 acres, and on the improved area of 750 acres he has increased carrying capacity by 1.6 ewe equivalents per acre (a 50 per cent increase) and wool production by 24.6 lb per acre (86 per cent increase). Production of sheep meat is 87,250 lb or 116.3 lb per acre.

Cattle meat produced is 35,000 lb (39 lb per acre), and the total meat production (sheep and cattle) from the total grazable area of 900 acres is 122,250 lb (135.75 lb per acre). In the autumn of 1960 he sold 18 chiller beef cattle only 20 months old.

General Features of Western Hills Farming

The western hill country occupies about 500,000 acres at the foot of the Western Ranges. It is steep to undulating with some deep gorges, especially in the north. The land tilts slightly to the south-east and is drained by three main rivers, Ngaruroro, Tutaekuri, and Tukituki, and many tributaries which flow south-east across the Heretaunga Plains, entering the sea south of Napier. Most of the flats are elevated terraces near rivers and streams. The hills are between 1,000 to 3,000 ft high near the ranges. Rainfall ranges from 40 to 80 in. per year and temperatures from over 80 degrees F in summer to as low as 15 degrees F during winter.

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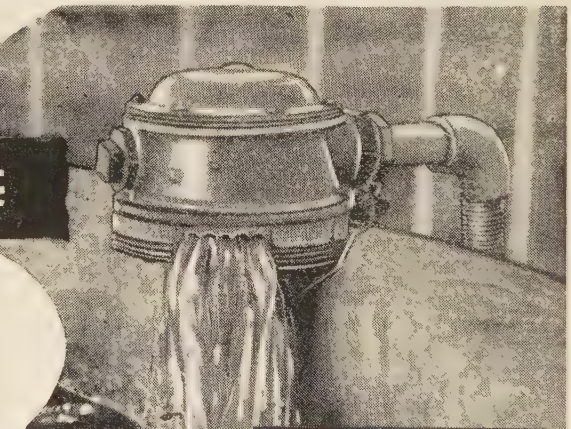

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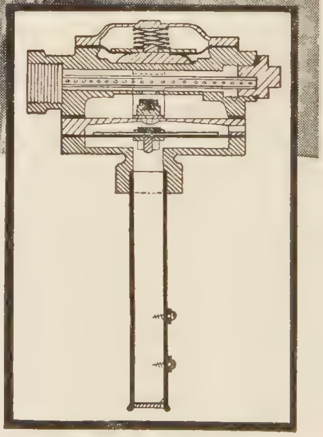
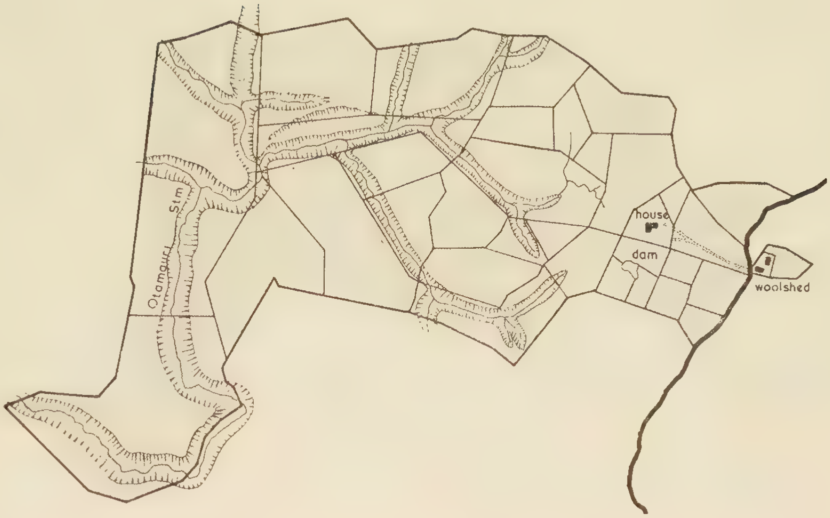


HAWKE'S BAY SHEEP FARM



Plan of farm, showing streams, with gorges sketched in.

Farming is predominantly sheep and cattle breeding, with some fat lambs and fat cattle. Supplementary crops are grown for winter feed and also used in rotation with a pasture renewal policy. In the south odd crops of wheat are grown in the rotation.

There are two distinct soil groups. The hills north of the Ngaruroro River are covered with volcanic ash soils and are part of the central North Island volcanic ash zone. South of the Ngaruroro River and approximately in a line a few miles west of Waipukurau and Waipawa lies hill country the greater part of which was once covered with native forest. The soils, sometimes referred to as "bush soils", contain no volcanic ash.

The original vegetation on the hills in the north was scattered native bush, fern, manuka scrub, pockets of native grass, and, on the higher country, tussock. Very little of the native bush remains.

The light texture of both soil groups has created problems because in some places, especially the higher country, wind and sheet erosion has removed the topsoil and all vegetation, exposing the parent rock.

Development has mainly been through removal of scrub and fern by giant discing where possible and fencing, oversowing, and topdressing of the native grass country. Extermination of rabbits solved one of the main problems in the establishment of good pastures. Though the annual rainfall is over 40 in., it is not always well distributed, and occasional long, extremely dry periods force disposal of surplus cattle if supplementary feed is not available.

On the lower rainfall areas subterranean clover and, in recent years, cocksfoot and red and white clover, have played a large part in increasing production.

Soil fertility is generally lower than in the central and coastal hills of Hawke's Bay. Phosphate has been the key to the establishment and maintenance of better pasture; subdivision fencing has been essential in keeping pasture production high. With the improved pastures grass grubs have increased markedly, and DDT superphosphate must be used when sowing down and be applied every three to four years on established swards.

Drainage is not a problem generally, though some wet depressions are favourable to rushes. Construction of surface drains and graded banks to divert run-off has markedly improved drainage.

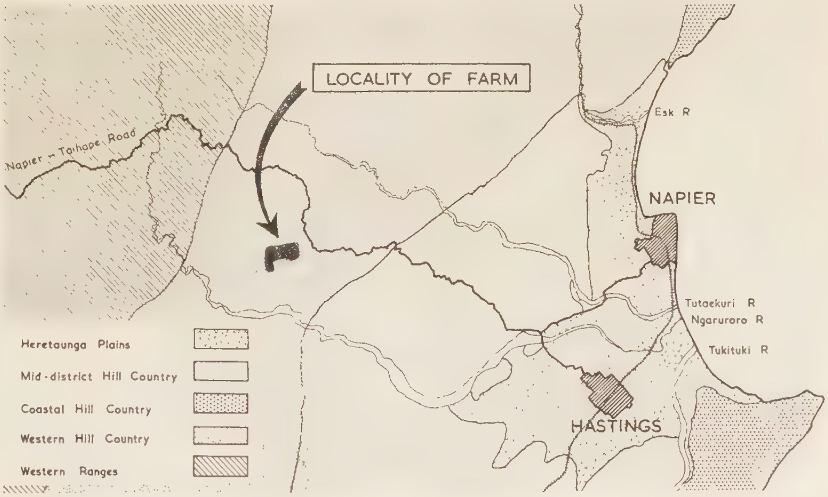
Erosion is not prominent on the lower foothill country, and little slumping takes place, but on the steeper gully faces some wind and water erosion shows up. Where possible the original cover is left or exotic trees are planted.

The main weed is nodding thistle, which has caused some concern where control has been neglected. Repeated hormone sprayings as soon as it appears have kept it under control.

In the past stock water has mainly come from streams in the gullies, but subdivision has made necessary the construction of stock water dams. The porous soil, especially in the ash shower country, makes careful siting of dams necessary. Unless dams are properly constructed, that is, with maximum consolidation on banks so sited that they are subjected to only minimum lash from the prevailing wind and waves, they will wash out after heavy, continuous rain. Overflow channels need to be a full dozer-blade wide.

The pumice soil in the area is known to be cobalt deficient and cobaltised superphosphate must be regularly applied.

Introduction of higher-producing pasture mixtures, topdressing, and better grazing techniques markedly reduced the winter dormant period of pasture growth over the western hill country. Where old pastures are being ripped up and resown, 3 cwt of DDT superphosphate is sown with the seed and a further 2 cwt of cobaltised superphosphate applied in spring. In



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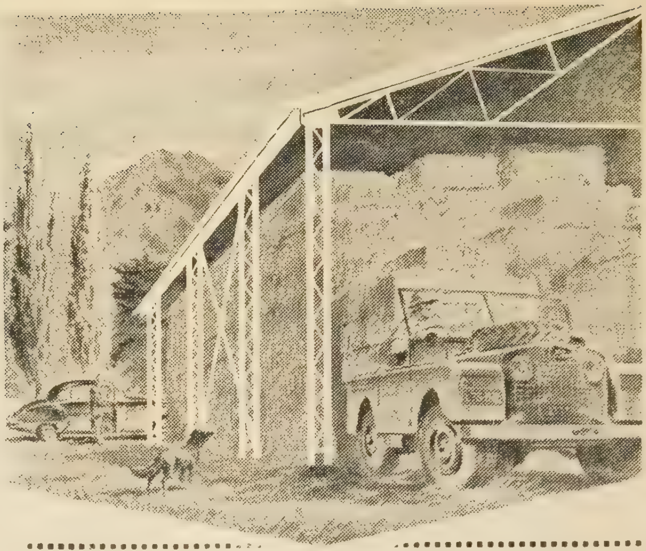

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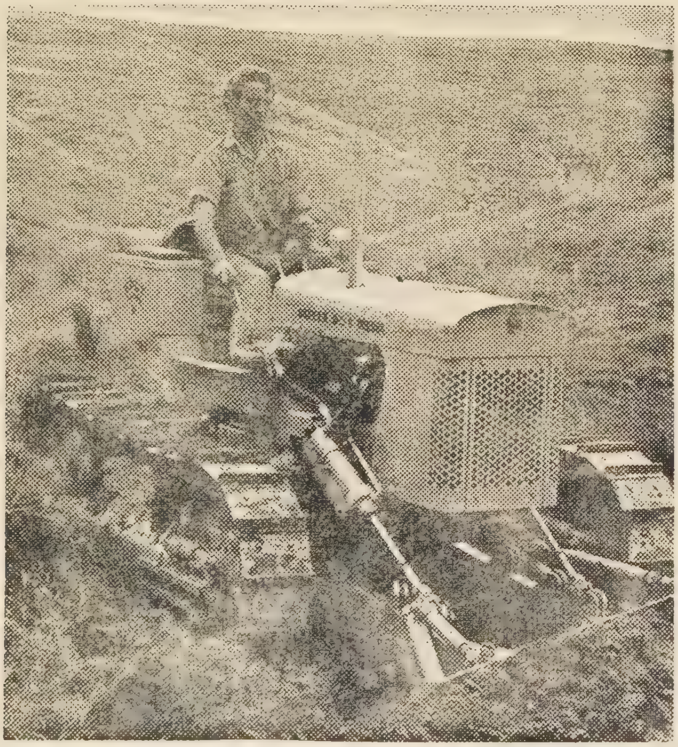

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autumn these new pastures receive a further 2 to 3 cwt of straight or serpentine superphosphate. This 7 to 8 cwt of phosphate applied in the first 12 months has achieved outstanding results, and good pastures can be maintained with 1½ to 2 cwt of superphosphate annually.

After some years of phosphate topdressing lime is also being used at 1 ton per acre every three to four years. More use is also being made of potash, and applications on established pastures are DDT superphosphate, or cobaltised superphosphate, or potassic superphosphate, or serpentine superphosphate.

Farm before Development

Mr McNeill took over his 1,254-acre property, about 1,100 ft above sea level, in 1947. The cover then consisted of 580 acres of once-ploughed ground with subterranean clover dominant pasture, 100 acres of which was very inferior; 215 acres of native grasses; 229 acres of fern and scrub; and 230 acres of more or less barren land. About 680 acres are ploughable by crawler tractor, 364 acres consist of gorges and broken country, and 210 acres moderate to steep hill slopes.

Originally there were 20 paddocks and fencing was in a poor state. The Otamauri stream and subsidiary creeks and springs supplied water to 12 paddocks. Buildings on the farm when it was bought were the original homestead, the woolshed, and small outbuildings.

Stock

Heavy rabbit infestation depressed stock-carrying capacity. In autumn 1948 the stock consisted of 2,000 ewes, all mated to Southdown and Dorset Horn rams for fat-lamb production, 650 dry sheep, and 100 cattle.

▲ Chou moellier being fed off before recultivation (new grass in background).

Stock production was about 80 per cent lambing, 82 per cent calving, about 21,500 lb of wool (8 lb per head) and remarkably high lamb weights of 37 to 41 lb for first drafts off the subterranean clover pastures. Death rates were quite high.

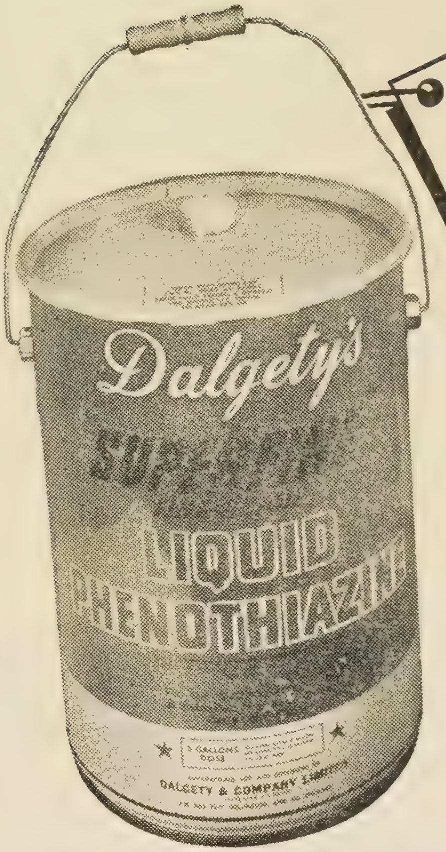
Development and Improvement

Rabbits

Development and improvement of this land depended on the solution of problems common to the other settlers in the area.

Mr McNeill's first problem was to rid his property of rabbits. The initial

▼ Rolling country with undeveloped country further back.



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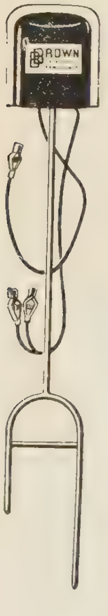

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kill destroyed about 10 rabbits per acre and continual hard work was necessary for eradication for a number of years.

Topdressing and Pasture Improvement

Maintaining the original subterranean clover-dominant pastures was handicapped at first by superphosphate rationing, but the 22½ tons available was put to best advantage on the most vigorous and responsive pastures and was helped by a little blood and bone in the first year.

About 40 acres were ploughed annually and crops of chou moellier and summer rape taken before sowing back to new grass. The new sowing aimed at establishing as soon as possible a mixed pasture of perennial ryegrass, cocksfoot, and white and subterranean clover. However, under the initial low-fertility conditions, subterranean clover very much dominated the sward, especially in spring and autumn.

With judicious rotational grazing and the use of more superphosphate when rationing ceased, the other introduced grasses and clovers largely replaced the subterranean clover. Once better-balanced swards were obtained and the fluctuating extremes in pasture production evened out, the ewe flock was changed over from producing fat lambs to breeding ewes. This changeover was started in 1951 and was completed by 1958.

By this time about 1¾ cwt of superphosphate per acre was being applied annually, but results in the following years were not satisfactory and in 1955 the Department of Agriculture cooperated with Mr McNeill in laying down an intensive topdressing experiment incorporating many trace elements and varying rates of lime, phosphate, and potash.

These trials produced no response to trace elements, but a very definite response to lime, potash, and superphosphate at 3 cwt or more per acre.

A cobalt trial was also carried out on the lambs, and the treated stock showed an increase of 3½ lb per head in live weight over untreated stock.

Since these trials the policy has been to sow new grass with 3 cwt of superphosphate in autumn and follow up with 2 cwt in spring, and then apply 2 cwt of cobaltised superphosphate annually.

Grass grub was early recognised for the menace it is, and new grass sowings are protected with DDT applied in the initial superphosphate dressing.

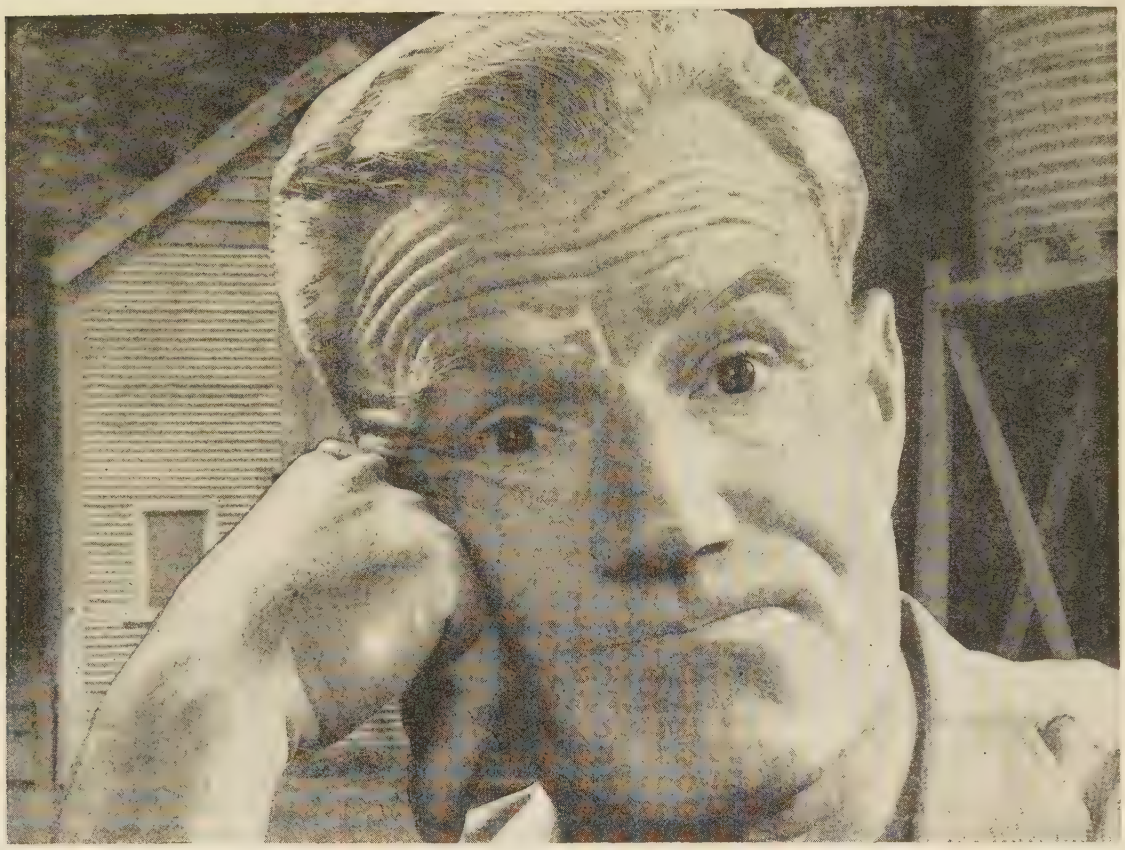
In more recent years the original pasture mixtures of perennial ryegrass, cocksfoot, and subterranean and white clover have been changed to special-purpose mixtures featuring certified cocksfoot, Italian and short-rotation ryegrass, red clover, and timothy. Results from these pastures have been outstanding, particularly with hoggets and yearlings.

Stock Policy

The stock policy had to be moulded to the subterranean clover dominant pastures producing flushes of growth in autumn and spring but very little at other times. So in the first few years all the ewes were put to the Southdown or Dorset Horn rams and very good lamb weights were taken off these pastures. To maintain the flock some 600 two-tooth ewes were bought in annually.

The cast ewes were fattened before being sold.

all right, I'll buy it...



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▲ Well grown weaner cattle.

The 100-odd cattle were fed inadequately in the initial years and were worked round the property to control rough growth.

Stock carried in 1948 were 2,636 sheep and 90 cattle. Wool clipped was about 21,500 lb—8 lb per sheep.

In 1949 there were 2,660 sheep and 90 cattle. Wool clipped was 24,000 lb—9 lb per sheep.

By this time the rotational or mob-stocking grazing practised up to lambing was showing results in improved pastures on most of the farm.

In 1950 there were 2,350 ewes, 460 dry sheep, and 94 cattle. The wool clip held firm at 9 lb per head and the lambing percentage increased to over 90. In 1951 the change to a breeding flock was made; 460 five-year-old ewes were bought in for three seasons and the present flock is descended from these sheep.

During the transition both management and finance were difficult. There was neither a fat lamb nor a breeding flock, and stock management of pastures with divided mobs of sheep was difficult. As the subterranean clover was displaced by an increasing proportion of ryegrass and white clover, lamb weights dropped sharply to 33 to 34 lb.

However, by 1955, 3,190 sheep and 200 cattle were being carried, almost entirely on the 680 acres of ploughed country, and rotational grazing was in general use.

From 1955 stock numbers steadily increased and lambing percentages, wool weights, lamb weights, and stock thrift all improved with the benefits of the good pasture management. Continued cropping, increased superphosphate application, cutting of hay, use of cobalt, and the introduction of special mixed pastures also contributed markedly.

General Farm Improvements

Fencing

Adequate subdivision was another necessity. Rapid improvement was affected by shortage of fencing materials, but progress was made and good control of stock obtained.

Water Supply

Water supply on this country became a critical factor with the increasing paddocks. The porous soil complicated dam building, but with valuable assistance from the Hawke's Bay Catchment Board and the Department of Agriculture two dams were built. The larger of these can hold 4½ million gallons of water. Water is pumped from the dam to a reservoir, then gravitated through 7,000 ft of piping to 16 troughs dispersed throughout the farm. The Catchment Board also helped with space planting of poplars in gullies and on some of the steeper slopes.

Buildings and Labour

At take-over in 1947-48 the owner and one man worked the property. Development and increasing stock numbers required more labour. In 1950 a 1,100 sq. ft. shepherd's cottage was built and later a much needed hay barn and an implement shed of 1,400 sq. ft. The present labour force is the owner, a married shepherd, and a youth. Contract fencers are employed when required.

Present Stage of Development

The ploughed country now consists of 670 acres (138 acres in special pastures, 512 acres in good ryegrass-white clover pastures, and 20 acres in chou moellier). There are 70 acres of uncultivated, but improved, steeper faces; 140 acres of steep hillsides and slopes of manuka and waste; 364 acres of gorge country still in native grasses, and some scrub (150 acres grazable).

There are 32 paddocks, all supplied with water, and adequate buildings in good repair.

In 1959-60 stock carried were 3,450 sheep (2,400 Romney-cross mixed-age ewes, 900 Romney ewe hoggets, and 150 dry sheep and rams), and 224 cattle (76 Aberdeen Angus breeding cows, 27 20-month heifers, 31 20-month steers, 10 dry cows and bulls, 10 fattening steers, and 70 weaner cattle). On the 750 acres of developed country these were increases from take-over of 800 sheep and 134 cattle, that is, 1.6 ewe equivalents per acre.

Wool production for 1958-59 was 40,056 lb and in 1959-60 there was a further steep rise to 44,019 lb. This was an increase in the total wool clip of 22,449 lb since the farm was bought. Lambing percentage in the last two years has averaged 100—a 20 per cent increase.

Lamb weights averaged 35 lb, which though lower than the 1947-48 figure, is more than in 1950. About 40 per cent of the total lambs born go away fat. All are sired by the Romney-cross ram.

Perhaps most improvement has been in the cattle—both in numbers and quality.

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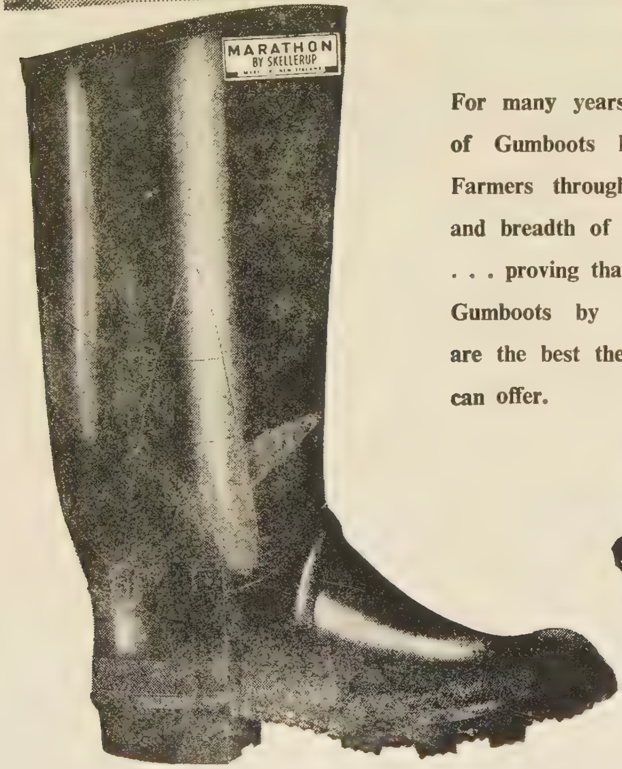
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Management Practices

The system of farming which Mr McNeill has evolved over the years is working very well.

Stock Management

The farming year begins with lambing at the end of July. Ewes and lambs are put on to saved pastures and set-stocked until weaning at the end of November. This weaning date is a month earlier than standard district practice. Lambing is correspondingly earlier than average, and could not be possible except for judicious saving of autumn flush growth through winter.

The earlier lambing allows drafts of fat lambs to be taken before ill-thrift problems arise. The first draft of wether lambs is taken before weaning in November. Later drafts are taken continually off red and white clover dominant pastures until most wether lambs go away fat.

There are four main shearings in summer—ewe hoggets and rams are shorn at the end of October, ewes at weaning, lambs just before Christmas, and then the two-tooths are shorn again in February to improve their lambing percentage.

Semi-improved country in the foreground; cattle are grazing the undeveloped country behind it.

After weaning, the ewe lambs are spread out as widely as possible—usually about five or six per acre. The ewes are used in large mobs to bring paddocks into order for later use of the weaned lambs, which must have fresh grass and clover grown to a maturity of 4 to 6 in. to prevent ill thrift.

Later the ewes are divided up for quality and wool type and set-stocked for two to three weeks on specially selected flushing paddocks before and after the rams go out for tupping. At first opportunity the ewes are remobbed and rotated until shortly before lambing begins again.

Fly crutching is done at the end of February and a full crutch given early in June.

During autumn the chou moellier crop is used in facial eczema emergencies, and then fully fed off in mid winter to the hoggets and cattle by rationed grazing. The ewes are easily carried through winter on grass alone. Rotating the mobs at 30 to 40 per acre prevents over-feeding and ensures adequate exercise, a big factor in preventing bearing trouble and other lambing problems. Diseases such as malignant oedema, blackleg, and epididymitis are guarded against by vaccination.

Dam to provide water for stock. It is 12 ft deep and covers ⅓ acre.

Rams are put out at 2½ per cent. Romneys only being used. Surplus ewe lambs are culled as hoggets in July and sold. Culls from the ewe flock either go to the works fat or are sold as five-year ewes.

Cattle play a very important part in promoting thrift in sheep and also in providing quite a large income. Calving now begins in August, a month earlier than in the past. The cows and older dry stock spend a big part of winter (June to October) on the 364 acres of gorge country. From October onward they are rotated with the ewes on the developed country to clean up paddocks ready for the ewe lambs. The calves are weaned in early April and spend their first winter on the best available pastures on the ploughable country. Hay is fed out to them until September. In recent years all cattle sold off the property have been sold fat, usually as two-and-a-half-year-olds.

Land Management

With the improved pastures, reliance on chou moellier as a wintering crop has not been so necessary. Rape, once needed as a fattening crop, is no longer grown and the area of chou moellier has been reduced by half to about 20 acres each year, and its biggest value now is as insurance against facial eczema. The chou moellier is sown in October-November with 4 lb of cowgrass seed per acre. After the crop is fed off in the following winter the red clover is allowed to come away in summer and provides valuable lamb fattening. The paddock is resown the following autumn.

Special-purpose pastures, which are a feature of the property, are used for fattening cattle in summer, for wintering sheep, for autumn growth for further prevention of hogget ill thrift, and for hay crops.

Cutting about 15 acres every second year yields about 1,200 bales (80 bales per acre) of good-quality short-rotation ryegrass and red clover hay.

Some of the pasture mixtures are as follows (crested dogstail excepted, all seed is certified):

Permanent Pasture No. 1

	lb
Cocksfoot	10
Perennial ryegrass	10
Timothy	3
Crested dogstail	1
Mount Barker subterranean clover	1
Cowgrass	2
Montgomery red clover	2
White clover	2
Per acre	31

Hogget Ill Thrift and Cattle Fattening

	lb
Cocksfoot	6
Montgomery red clover	4
Per acre	10

Hay and Fattening

	lb
Short-rotation ryegrass	20
Montgomery red clover	6
Per acre	26

Winter Carrying and Summer Fattening

	lb
Short-rotation ryegrass	20
White clover	2
Montgomery red clover	6
Perennial ryegrass	6
Per acre	34

Permanent Pasture No. 2

	lb
Perennial ryegrass	20
Cocksfoot	8
Crested dogstail	1
Timothy	2
White clover	2
Montgomery red clover	2
Per acre	35

This last pasture, sown in 1956, has carried over the last 12 months 6 ewes plus .6 of a cattle beast per acre.

Topdressing continues along the lines described under Development. Heavy superphosphate dressings incorporating cobalt are applied annually. Recently 180 acres has received 1 ton of carbonate of lime per acre. More will be done in the future. Potash is producing marked responses, especially in paddocks cut for hay. DDT superphosphate is being used regularly as insurance against grass grub.

The 364 acres of gorge country partly covered in scrub, fern, and native grasses has not been specially developed. No superphosphate or seed has been applied. In its native state this area has proved invaluable for wintering cattle in times of feed shortage, especially in late winter. This treatment and spelling in summer are changing the area from native grasses to a much superior cocksfoot dominant sward without expenditure. Mr McNeill intends to leave it this way.

Freedom - from - Hunger Campaign

Famine victims at Khulna, East Pakistan. Though the charitable supply of food in famine is usually readily forthcoming it brings temporary relief only. The problems of world food supplies do not relate so much to particular famine periods, generally caused by drought or flood, but to the chronic malnutrition from which a large part of the world's population is suffering and in particular the problems imposed by the rapid increase in population.

What is needed where food is scarce is to break the vicious circle of starvation and give the local people the wherewithal to fend for themselves. Such action must be started on the spot, but outside assistance is essential.

The basis of the Freedom-from-Hunger Campaign is to stimulate action by member governments toward increased food production, more efficient distribution, and better nutrition among the less favoured peoples.

BROAD BEANS

Causes of Poor Yields Sought

By W. BRANDENBURG,
Horticultural Instructor, Department of Agriculture, Christchurch

DATA obtained mainly in Canterbury indicate that the acreage of broad beans grown for marketing fresh has increased only slowly in recent years, though since these beans came to be used for deep freeze about three years ago, the total acreage has increased considerably. Broad beans are thus a crop of some importance in New Zealand, but they could become much more popular among commercial growers if the poor yields common throughout the country could be improved. A recently recognised virus disease is partly the cause of low yields, but the main cause seems to be a generally poor setting of pods. To determine the reasons for this poor setting and to find improvement methods an investigation, including study of the part of pollinating insects, was begun in the Hamilton district in September 1957. The author of this article was formerly stationed at Hamilton, and here describes the results of the investigation, in which C. R. Paterson, Apiculturist, and A. W. Bennett, Apiary Instructor, both of the Department of Agriculture, Hamilton, cooperated.

THE broad bean's Latin name, *Vicia faba*, indicates that it is not really a bean (Latin name, *Phaseolus*), but rather a species of vetch (Latin name, *Vicia*), and is a member of the pea family, which is a very large one containing many plants of economic importance.

Flowers and Mechanism of Pollination

Because of their structure broad bean flowers are adapted to pollination by long-tongued insects.

Every flower consists of five petals united into a tube over part of their length. The top one is most conspicuous and is called the standard or flag. Sideways and downward are two smaller petals called the wings, and between these the remaining pair of petals is united into a little purse called the keel, which encloses the reproductive organs (the stamens and pistil) of the flower.

The keel and the wings together form a landing place for insects that come to gather pollen or nectar. Under the weight of the alighting insect the keel is forced down and liberates the pistil and anthers through a slit in the top and the pollen is discharged.

Some usually gets direct on to the pistil and some is deposited on the underparts of the visiting insect. The actual mechanism of this pollen discharge varies slightly between species, but generally it does not clearly indicate by its action whether self- or cross-pollination is the aim. Most members of the pea family will set seed after self-pollination has been effected by an insect and some of them, including the garden pea, will set seed satisfactorily in the total absence of insects.

Method of Pollination

In an investigation of the pollination requirements of broad beans two basic questions must first be answered:

1. Will broad beans set seed by self-pollination in the absence of insects?
2. What insects are the main pollinators of broad beans in New Zealand?

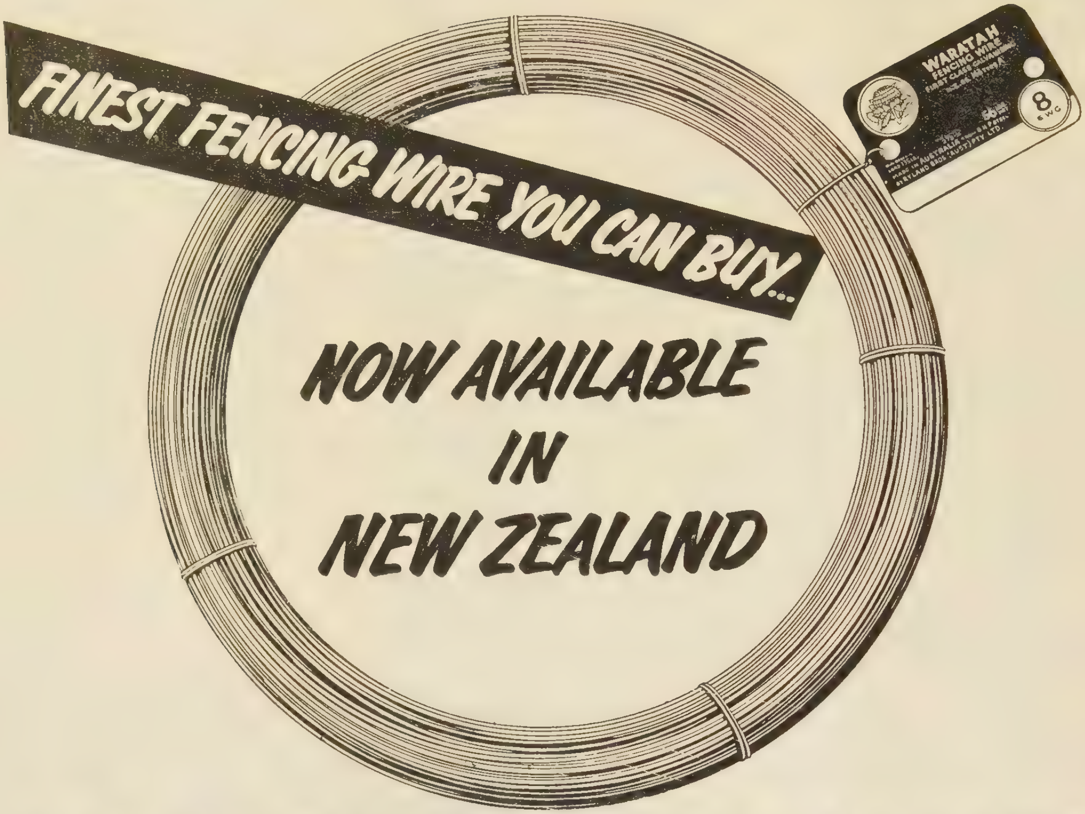
Pollination without Insects

In the investigation to determine if the beans would set seed without pollinating insects insect-proof cages were placed over two groups of 20 plants in each of the two separate trial areas. At the end of the trial period the average number of pods per stem that had set was determined as 0.03 for one area and 0.28 for the other, compared with 4.4 and 7.4 outside, where insects had access to the flowers. In other words, the number of pods set in the absence of insects was negligible.

An attempt was made at the same time to ascertain whether climate could be involved in the poor pod setting. It was decided that temperature was a possible factor and to determine its effects on pollination plastic shelters were built, each covering 20 plants, in each of the two trial areas. To afford entry to pollinating insects a large opening was left in the side of the shelter away from the wind, care being taken that the shape of the opening could not make it act as a trap for insects.

Daily readings showed that the average daily maximum temperature was 13.4 degrees F higher under the plastic than outside, but the average

At each node on a well developed broad bean plant there are several flowers available for pollination. Observations made during the trial show that pollinating insects are essential in the setting of pods on broad beans.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MADE BY **RYLAND BROS. (AUSTRALIA) PTY. LTD.,** NEWCASTLE, N.S.W., AUSTRALIA.

daily minimum under the plastic was 0.4 degrees F lower than outside. As a result of the shelter created under the plastic, large numbers of insects were continuously at work on the broad bean plants. In spite of this, pod setting was very much lower than outside. The average number of pods per stem was about one under the first shelter, while adjacent plants outside yielded 7.4 pods per stem. Under the second shelter the average set was half a pod per stem, while outdoor plants in the same area yielded 4.4 pods per stem.

This indicates that more than just one factor is involved in the poor setting of broad beans. Though the trial has proved that insects are needed for pollination of broad beans, a climate factor apparently influences the result of their activity. The method of observation available was not sensitive enough to establish beyond doubt which factor was responsible. There is a strong likelihood, however, that either the very much increased daily maximum temperatures or the temperature fluctuations induced by the plastic shelters are the cause. This is in line with field observations, which show that in spite of satisfactory bumble bee activity late in spring and in early summer, broad bean crops tend to go off as the season advances.

Main Pollinating Insect

On the second basic question, "What is the main pollinating insect?", the answer seems to be that under natural conditions the main pollinating insects for members of the pea family, which includes broad beans, are bumble bees. Literature on bumble bees in New Zealand discloses that after repeated attempts around the turn of the century three species of bumble bee were successfully established in New Zealand. They are listed here, with a few observations about their main habits and characteristics that are important for pollination of this crop.

Bombus terrestris

> ***Bombus terrestris*** **has altered its habits since its introduction into New Zealand, possibly owing to the milder climate. Colonies tend to become perennial and only barely dormant during winter.**

In the area of its origin (Europe and Asia) its nest was very small and the population, apart from the overwintering queens, died out in autumn. In New Zealand very large nests are built. They tend to become perennial and some activity goes on all winter; even in the colder parts of the country bumble bees of this species can be seen about on sunny days at any time during winter. This fact is important in the consideration of the broad bean problem.

A second important characteristic is that this species has a short tongue and is unable to reach nectar that is deeply hidden in flowers. To get at the nectar it resorts to biting holes in the tubular part of the corolla at the back of the flower.

Bombus ruderatus

Bombus ruderatus **has retained its normal overwintering habits and is less hardy than** *Bombus terrestris.* Nests are of only limited size and the population, apart from the overwintering queens, dies out completely. This bumble bee is late to appear in spring and takes some time to build up in numbers. At least in the trial area near Hamilton it provided the greatest number of bumble bees present in summer.

> **This species has a long tongue and can reach the nectar in the flowers of every member of the pea family grown in New Zealand when it enters the flower in the normal manner.**

Bombus subterraneus

> ***Bombus subterraneus*** **has succeeded in establishing itself only in Canterbury and Otago as far as is known. Its habits and characteristics are essentially similar to those of** ***Bombus ruderatus.***

The Pollination Problem

From the data presented the problem largely outlines itself. Broad beans will not set pods properly without the help of pollinating insects. The beans are grown during winter and early spring for the reasons that (1) they will grow through winter to provide a spring crop, and (2) black aphids become a difficult problem as spring progresses. There appears to be no easy way to reduce this problem, as the crop flowers almost through its entire life and must not be sprayed with insecticides or the pollinators will be killed. In early spring the first bumble bee to appear is *Bombus terrestris,* which punctures the flowers and is useless as a pollinator on this crop. By the time the useful species of bumble bees become abundant the crop is generally due for harvest.

A few other observations made during the trial tend to disprove some generally popular misconceptions about broad beans. As stated earlier one of these misconceptions, that broad beans can set pods without the help of insects, has already been disproved. On the contrary it has been observed that **pollinating insects are essential.**

A second misconception is that the puncturing by *Bombus terrestris* to get at the nectar of broad beans damages vital parts of the flowers and prevents their setting pods. In this investigation 50 punctured flowers, collected at random, were dissected and examined under the microscope. In 49 out of the 50 damage was confined to the petals, and in only one flower was there slight damage to the underlying stamen tube, which is still not a vital part in pod production. The ovary lies inside this again and was untouched in all cases.

In addition, a composite sample of flowers that had failed to set was sent to the laboratory of the Plant Diseases Division, Department of Scientific and Industrial Research, Auckland, with the request to examine them for the presence of fungi that might have caused disease. No pathogenic organisms were found.

All this was confirmed by numerous observations in the trial area, where it was found that many punctured flowers were setting perfect pods. This shows that puncturing of broad bean flowers by *Bombus terrestris* does not damage vital parts of the flowers, and if a punctured flower is subsequently pollinated in the normal way, pod setting will occur.

Honey Bees Used

An attempt was made in a trial to improve pod setting by introducing hives of honey bees into the crop. There were two trial areas, about 3 miles apart, and broad bean crops were grown under conditions that were as identical as possible on each. Soil analysis showed no significant differences in soil conditions. The manurial programmes used were similar. The same variety of broad beans was sown on both, with seed from the same source. Both crops were sown on the same date by the two market gardeners cooperating in the trial. One difference that could not be altered was that the area in Frankton was considerably better sheltered than the area at Rototuna and this probably had some effect on the outcome of the trial.

Four strong beehives were placed near the crop at Rototuna. Results were determined by pod counts on 100 stems selected at random in the crop and the average number of pods per stem was determined. Over most of the period of recording, the crop with the beehives carried twice as many pods as the untreated crop.

Owing to local market conditions at the time, the crops were not harvested and no crop weight figures are available. Because of the vigour of the plants, however, and the cropping habit of broad beans under more favourable circumstances overseas, there can be little doubt that the plants had sufficient reserves to ensure that all pods that had set would also mature. The improvement in pod setting obtained in the plot with hives was therefore certain to have resulted in a doubling of the yield as compared with the untreated crop.

However, as the Frankton crop had the better shelter, there was a much better cover by bumble bees. There were also many honey bees from nearby commercial apiaries working on this crop. On the other hand the Rototuna crop was poorly sheltered and there was much outside attraction for the hive bees on it in the form of hedge plants flowering during the broad bean period. Had the Rototuna area the natural advantages of the Frankton trial plot, it is probable that the difference in yield would have been even more in favour of the plot with hives.

The experiment showed that the placing of beehives in a broad bean crop is likely to improve yield significantly.

Another observation during the trial was that owing to the relatively sturdy construction of broad bean flowers, honey bees have quite a struggle to enter them. After having worked the crop faithfully for a full month the hive bees on the trial area suddenly appeared to realise that punctures made by bumble bees gave access to the flowers, and it was observed that in three days all honey bees stopped entering the flowers from the front and used the punctures for entry instead. Discussion of this observation with Apiary Instructors of the Department has made it clear that to get maximum results from honey bees on this crop it would be advisable to change the hives every seven to 14 days to prevent the bees from becoming familiar with the short cut.

Recommendations

No purpose is served in trying to kill bumble bees visiting broad bean crops and this action is strongly condemned.

Broad bean crops should, within the limitations of local climate and supply requirements, be grown as late in spring as possible. Aphid control without risk to pollinators should be investigated to make later cropping possible.

Shelter is important. Unless broad beans are grown in a solid block, in which case distances between the rows should be kept down as far as possible, it is better to grow them in double or triple rows than in single rows.

Placing of beehives in the crop will improve yields. Hives should be frequently changed so that bees will not get used to robbing flowers through bumble bee punctures.

Radio Broadcasts for Farmers

RADIO broadcasts for farmers will be given during April as follows:

1XH Hamilton, 12.33 p.m.

10 April—"Sterilisation of Milking Equipment", by L. E. Downs, Special Inspector, Department of Agriculture, Hamilton.

17 April—"Dairy Farming Prospects", by R. Woolerton, Federated Farmers, Hamilton.

24 April—"Ewe Flock Management", by L. Wells, Livestock Instructor, Department of Agriculture, Hamilton.

1YZ Rotorua, 7.15 p.m.

12 April—"Sterilisation of Milking Equipment", by L. E. Downs, Special Inspector, Department of Agriculture, Hamilton.

26 April—"End of Season Management and Culling Programmes", by E. O. Pedersen, Livestock Instructor, Department of Agriculture, Whakatane.

2XP New Plymouth, 8 p.m.

6 April—"News and Views from the Farm Advisory Division", by G. R. Moss, Farm Advisory Officer, Department of Agriculture, New Plymouth.

20 April—"Soil Preparations in the Vegetable Garden", by J. B. Laurenson, Plant Quarantine Officer, Department of Agriculture, New Plymouth.

27 April—"Radio Vet.", by J. H. Macdonald, Veterinarian, Department of Agriculture, New Plymouth.

4YA Dunedin and 4YZ Invercargill, 12.36 p.m.

10 April—"Farm Records as an Aid to Farm Improvement", by N. R. Woods, Farm Advisory Officer (Economics), Department of Agriculture, Dunedin.

17 April—"The Potato Crop", by A. R. Rankin, Fields Instructor, Department of Agriculture, Invercargill.

24 April—"Ratepayers' Cooperation with Rabbit Boards", by G. E. Tonks, Livestock Instructor, Department of Agriculture, Lumsden.

Regular Sessions

1YA Auckland, Mondays at 12.36 p.m. ("Country Journal", including "Report from Ruakura"), Tuesdays, Wednesdays, Thursdays, and Fridays at 12.33 p.m. ("Country Journal"), Thursdays at 12.33 p.m. ("News for the Farmer").

1XN Whangarei, Mondays at 8 p.m. ("Northland Stock Market Report", followed by "Farming for Profit"), Wednesdays at 8 p.m. ("Farming for Profit"), and Fridays at 12.33 p.m. ("Farm News").

1XH Hamilton, Mondays at 12.36 p.m. ("For the Farmer", excluding first Monday in month and public holidays), Wednesdays at 12.33 p.m. ("Report from Ruakura").

1YZ Rotorua, Wednesdays at 7 p.m. ("Bay of Plenty Journal"), Thursdays, 12.33 p.m. ("News for the Farmer").

2YZ Napier, Tuesdays at 7.10 p.m. ("The Hawke's Bay Farmer"), and Thursdays at 12.33 p.m. ("News for the Farmer").

2XG Gisborne, Tuesdays at 8 p.m. ("Farm Session").

2XP New Plymouth, Thursdays at 8 p.m. ("Farm Session").

2XA Wanganui, Mondays at 8 p.m. ("For the Man on the Land"), Tuesdays at 8 p.m. ("Farm Supplement"), and Thursdays at 8 p.m. ("Farm Topics").

2XB Masterton, Fridays at 6.45 p.m. ("Farm Session").

2XN Nelson, Thursdays at 8 p.m. ("Nelson Farm Topics").

2ZA Palmerston North, Mondays at 12.36 p.m. ("Country Digest"), and Fridays at 8.30 p.m. ("Country Digest", including Feilding stock market report).

2YA Wellington, Mondays, Tuesdays, and Fridays at 7.10 p.m. ("Farm Session"), Thursdays at 12.33 p.m. ("News for the Farmer").

3YA Christchurch, Mondays at 12.20 p.m. ("Country Session"), Thursdays at 12.33 p.m. ("News for the Farmer"), and 7.10 p.m. ("Home Paddock").

3XC Timaru, Wednesdays at 8 p.m. ("Farmers' Weekly News Service"), and Saturdays at 10.30 a.m. ("Country Mailbag").

3YZ Greymouth, Mondays at 12.36 p.m., Thursdays at 12.33 p.m. ("News for the Farmer").

4YA Dunedin, Mondays at 12.36 p.m.; Tuesdays at 12.33 p.m.; Wednesdays and Thursdays at 12.33 p.m.

4YZ Invercargill, Mondays at 12.36 p.m., Wednesdays and Thursdays at 12.33 p.m. ("News for the Farmer").

Agricultural and Pastoral Show Dates

THE following are dates and venues of A. and P. shows up to the end of April:

NORTH ISLAND

March

18 March—Wellsford A. and P. at Wellsford.

SOUTH ISLAND

March

18 March—Hawarden A. and P. at Hawarden.
*18 March—Upper Clutha A. and P. at Wanaka.
*25 March—Methven A. and P. at Methven.

April

3 April—Strath-Taieri A. and P. at Middlemarch.
3 April—Mackenzie Highland Show at Fairlie.
8 April—Oxford A. and P. at Oxford.
*15 April—Malvern A. and P. at Sheffield.

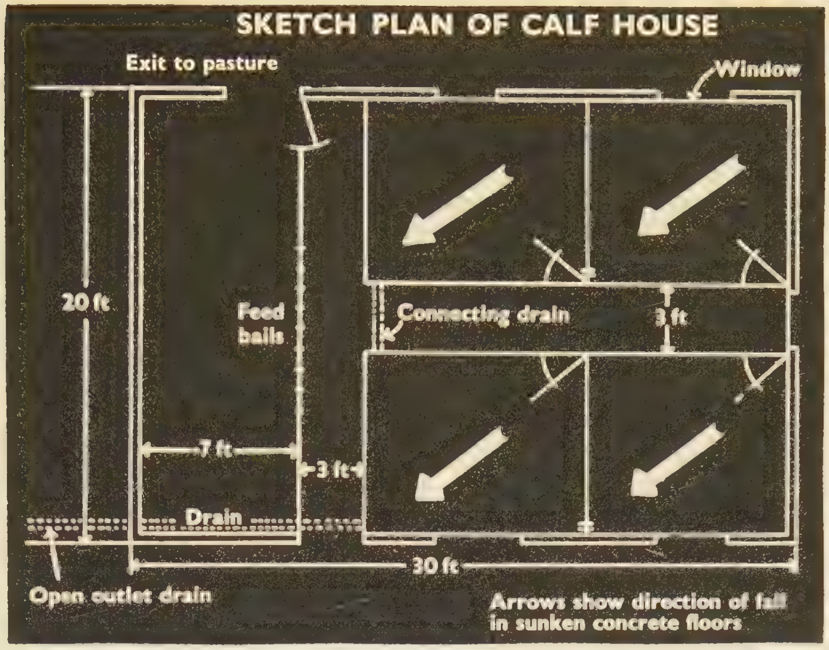
* The Department of Agriculture exhibit will be staged at this show.

Wool Sales

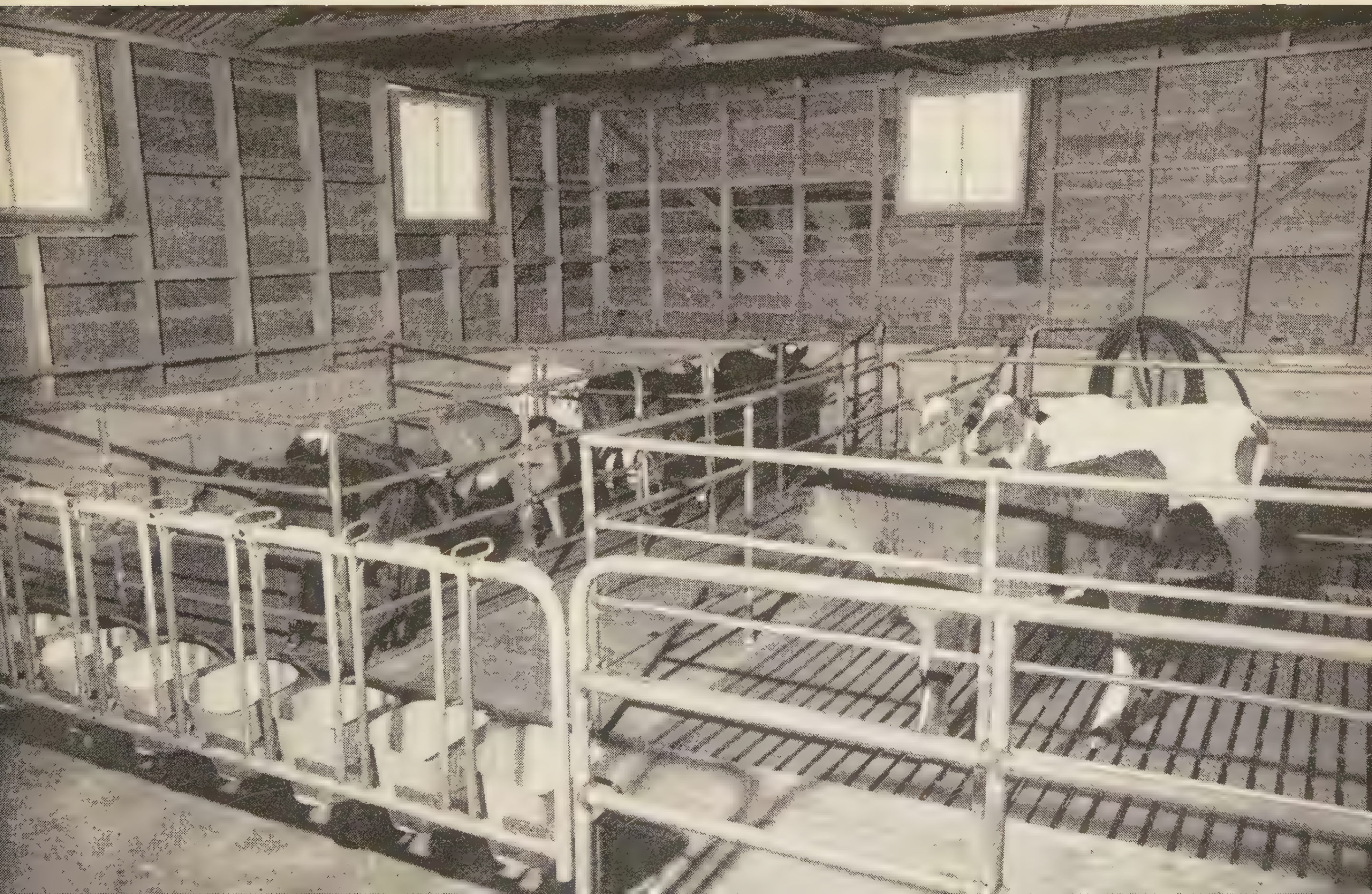
20 and 22 March: Auckland.
27 and 29 March: Napier.
12 and 14 April: Wellington.
19 and 21 April: Christchurch.
26 and 28 April: Invercargill.
3 May: Dunedin.
20 May Wanganui.
24 and 26 May: Napier.
31 May and 2 June: Auckland.
7 June: Wellington.

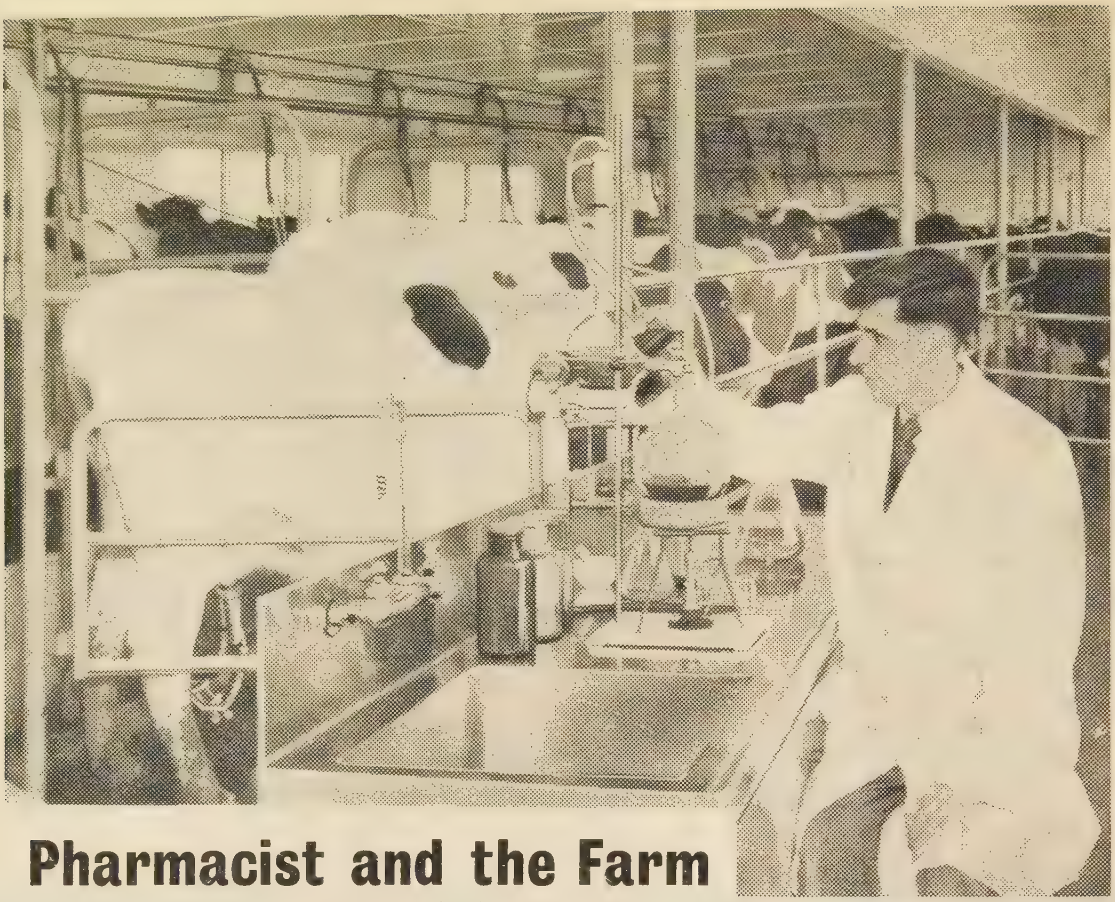
A Well Designed Calf House

By F. G. SHERWOOD,
Livestock Instructor,
Department of Agriculture,
Kaikohe.


SKETCH PLAN OF CALF HOUSE
Exit to pasture
Window
20 ft
Feed bails
Connecting drain
3 ft
7 ft
3 ft
Drain
30 ft
Open outlet drain
Arrows show direction of fall in sunken concrete floors

▼ Illustrated is a calf house on the property of Mr W. J. Cookson, a town supply milk producer with a large herd on fairly exposed country at Kawakawa in the Bay of Islands County. The annual rainfall on the farm would be about 65 in., and as this is often accompanied by strong winds, conditions can become very bitter. During the first two weeks of a calf's life shelter can be very important. If the weather is very unfavourable for several days, adequate shelter could save losses.





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"50"	50,000 units penicillin per tube.
"100"	100,000 units penicillin per tube.
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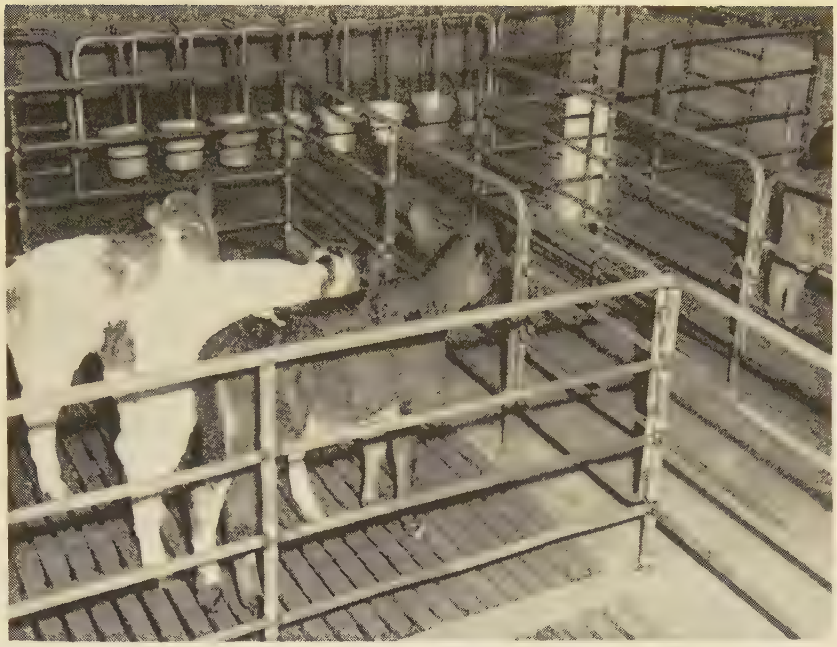
V4.0

A WELL DESIGNED CALF HOUSE

View from the back of calf → house showing exit to paddocks.



The door from the calf house opens on to a paddock with a northerly aspect suitable for the calves until weaning. Handy to the exit is a gate into an adjoining similar sized paddock which is also available for the calves. Further subdivision of these paddocks is planned to increase the number of changes of grazing available to the calves.

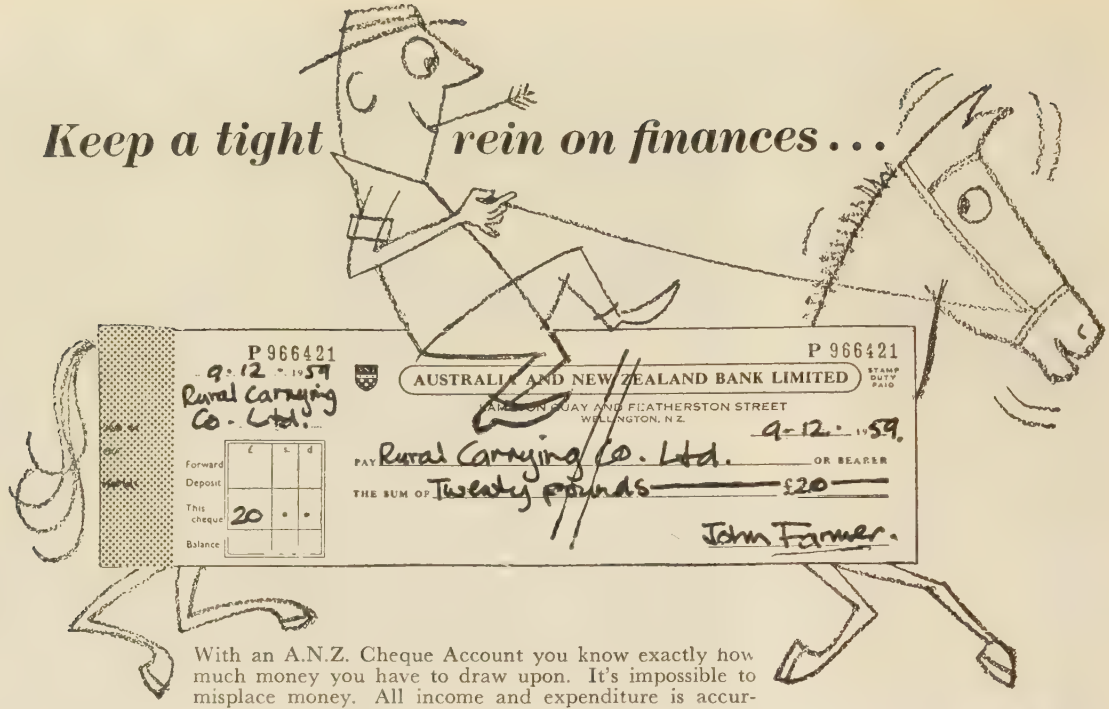
As a town milk supplier Mr Cookson has cows calving at all times, and with an average of 140 cows kept in milk throughout the year replacements of the right type are essential. Heifer calves are kept from April on and the length of their stay in the calf house depends on the weather, but they are always brought in for feeding.

In fine winter weather the calves may be let out into an adjoining paddock during the day, but are kept in the house overnight after the evening feed. Depending on the number of calves arriving and the weather at the time, the practice has been to keep new calves in the house pens for five days, after which the routine of out during the day and in at night begins. If the calves continue to thrive, they are then put out into an adjacent paddock from where they are brought into the house for twice daily feeding until weaning.

The calf house was built to provide fresh, clean housing for a maximum of 24 calves. It has been found that spreading hay over the slats is not satisfactory, as it complicates cleaning and drainage. The timber was from an old house on the farm.

↓ Entry door, feeding area, and position of outlet drain with wooden slats raised.

Keep a tight rein on finances . . .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9.12.1959
Rural Carrying Co. Ltd.
Forward
Deposit
This cheque
Balance
£ s. d
20 . .
P 966421
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STAMP DUTY PAID
QUAY AND FEATHERSTON STREET
WELLINGTON, N.Z.
9.12.1959.
PAY Rural Carrying Co. Ltd. OR BEARER
THE SUM OF Twenty pounds £20
John Farmer.

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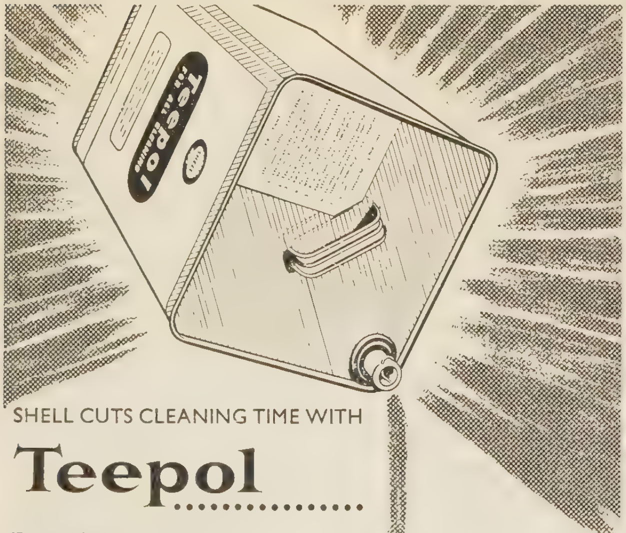

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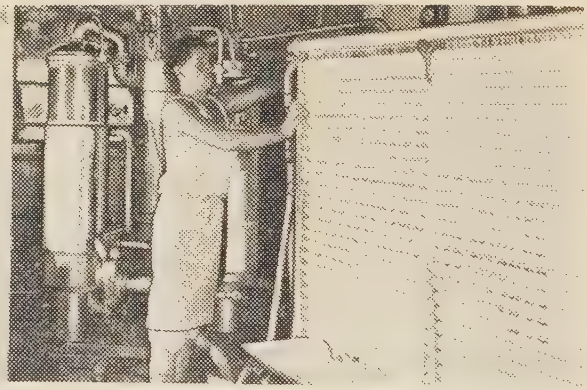

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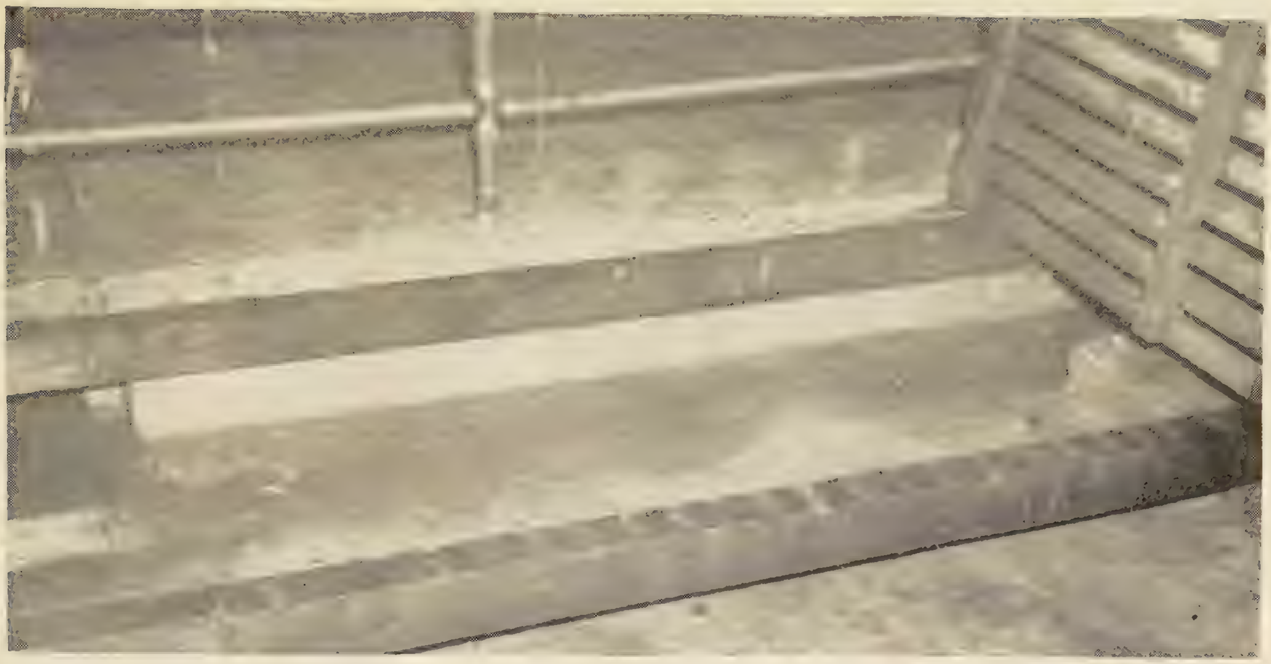
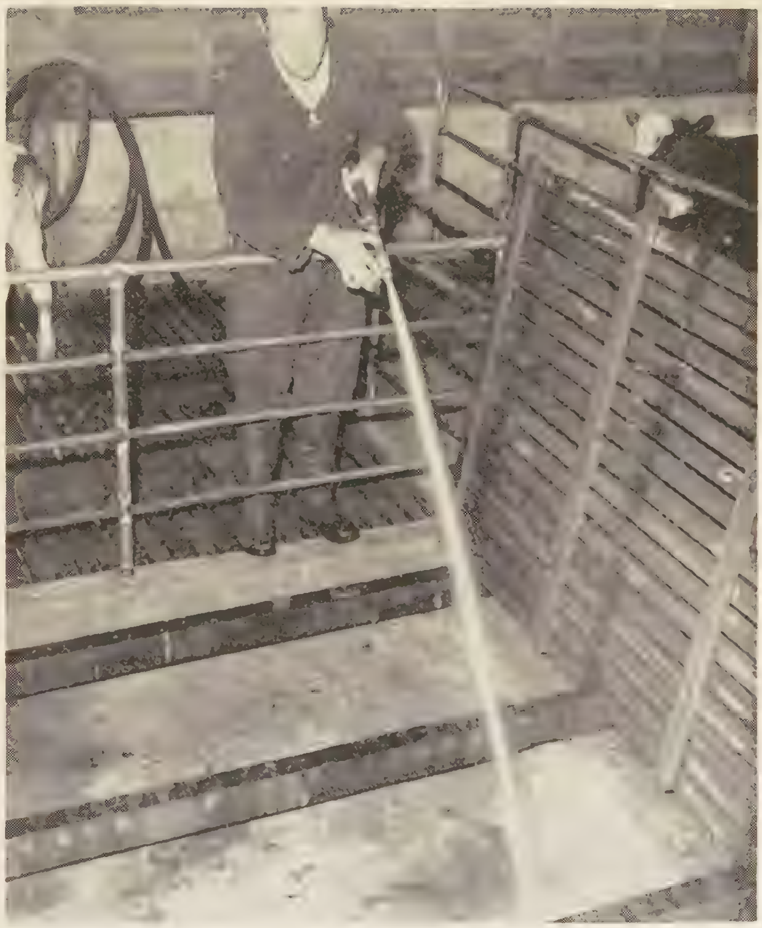


▲ Recessed concrete drainage pit under "duck walk" sections.

Slatted sections raised for cleaning of concrete drainage pits by high pressure hose. →



A plastered concrete foundation extends 3 ft up the walls and there are two 3 ft doors. Five windows 2 ft x 3 ft open to provide a good cross ventilation.

Two pens on either side of a central race hold six young calves each. At one end is a feeding area with bails to handle eight calves at once, and the feeding procedure is to fill the buckets and let a pen of calves down to the bails at a time.

The flooring in the four holding pens is in two sections of slats which may be raised separately for cleaning or lifted outside for placing in the sun.

Below these slatted sections is the sloping concrete floor which falls from 4 in. to 10 in. below the slats. These sunken floors are interconnected with glazed pipes and the whole four pen floors slope and drain toward a concreted outlet leading to an open drain outside.

Mr Cookson states that the calves rapidly settle down in this house and he has not lost any. The day the accompanying photographs were taken there was steady heavy rain and the calves appeared very contented.

◆

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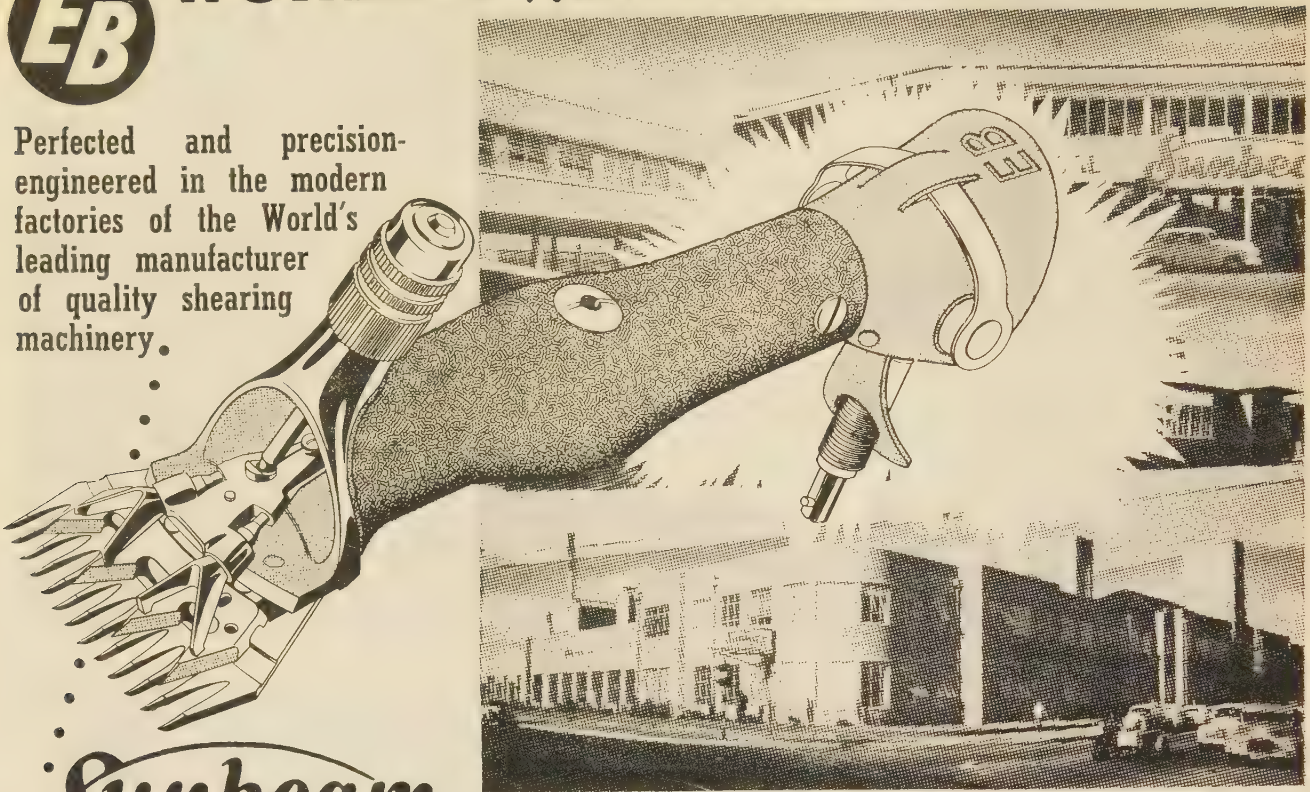

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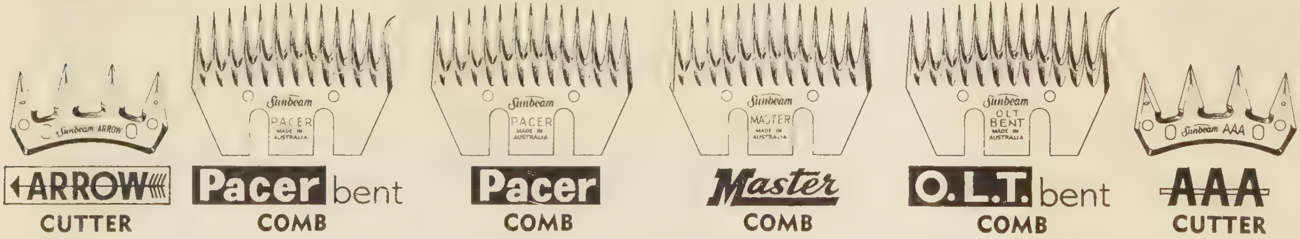
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Sunbeam OLT BENT MADE IN AUSTRALIA
Sunbeam AAA
ARROW CUTTER
Pacer bent COMB
Pacer COMB
Master COMB
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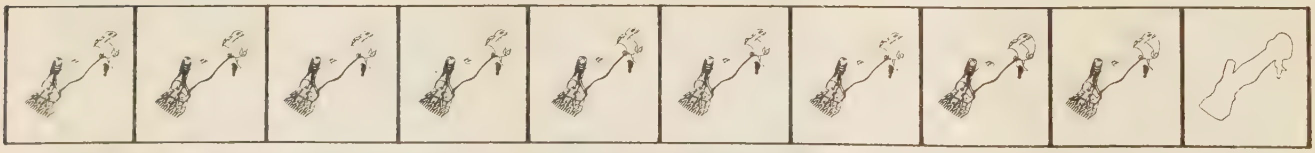

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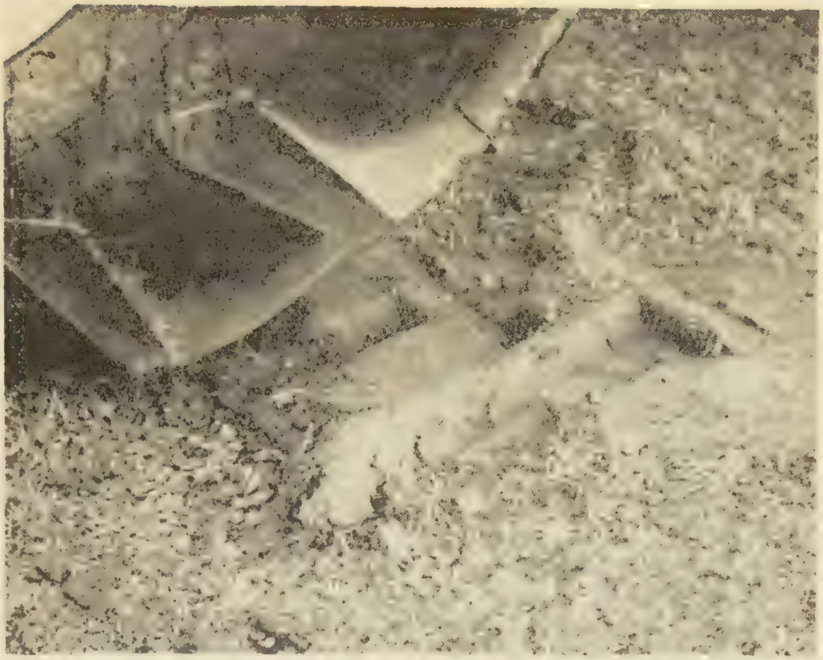
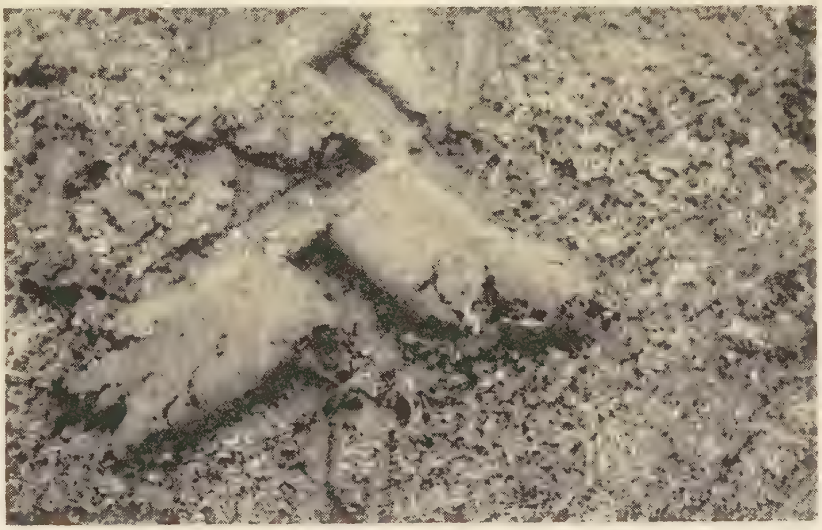
Tractor Tyre Treads

By C. M. B. OLIVECRONA,
Machinery Instructor,
Department of Agriculture,
Wellington

TRACTOR drivers should realise that *V-shaped tyre lugs designed for self cleaning when the tractor is travelling forward imprison and hold mud when the tractor is reversing → or braking. This type of lug, excellent for forward travel in muddy conditions, is a poor braking medium when the tractor is coming downhill with a load that tends to push it. The angled lugs designed for working mud to the outer edges of the tyre and to keep the treads reasonably clear while the machine is going forward do the very opposite when the machine is reversing or braking. Mud held into the treads begins to squeeze out only after → the centre has become fully packed.

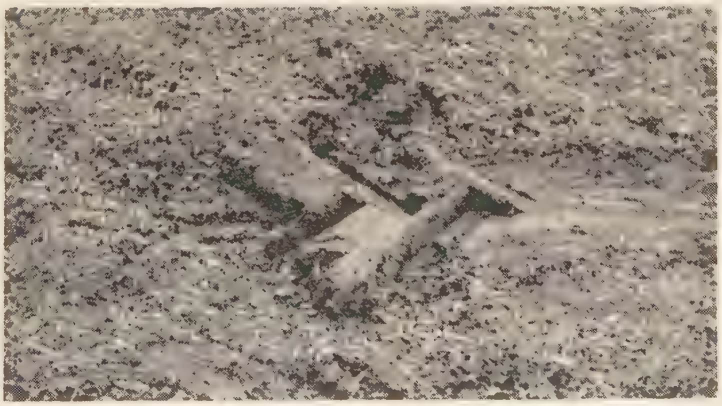




IN extreme circumstances, as in a skid (see bottom illustration), the tractor is virtually riding on a cushion of mud tightly packed and held in the tread's V-shaped lugs. It is essential when coming downhill to keep the tractor in gear, one of the lower gears, but not necessarily **low gear**. In low gear the wheels are likely to turn too slowly and skidding will begin as soon as the lugs become packed with mud. The same thing can happen in trying to brake a tractor with V-pattern angled-tread tyres either when coming downhill or on the flat.

Use of Wheel Grips

The use of wheel grips can help, but in muddy conditions tractor tyres are unlikely to have quite as good a grip coming downhill as going uphill on the same grade with the same load.



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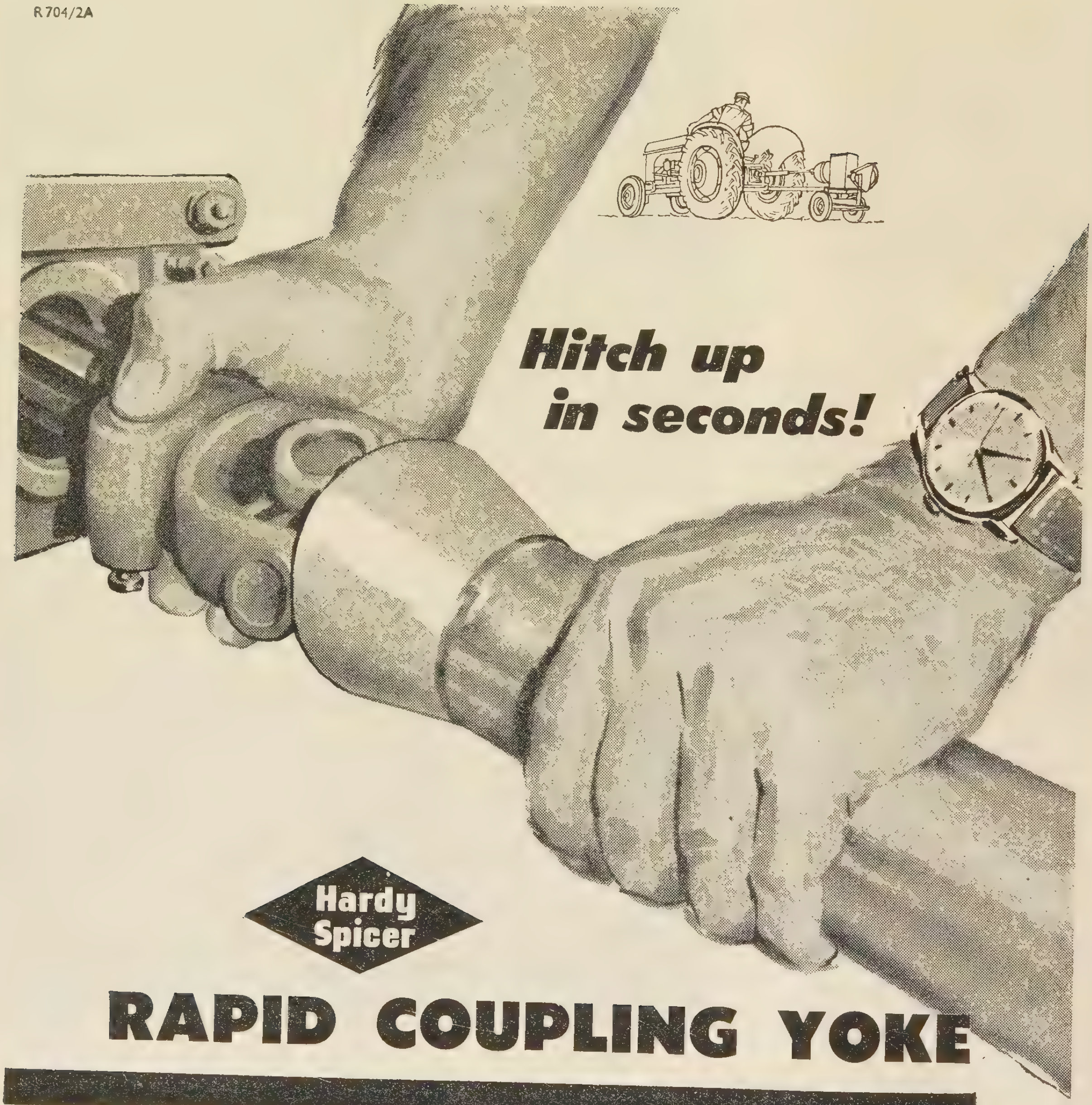
* The term "V" does not necessarily mean a closed V, but refers to any pattern of lugs angled for self cleaning.

R 704/2A



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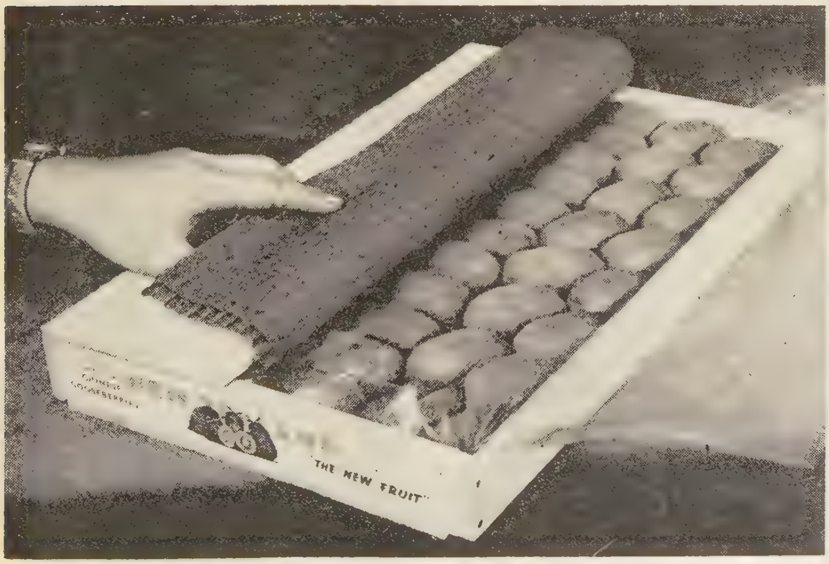
"THE NEW FRUIT"

[Renwood

Packed tray for export completely enveloped in polythene wrap. This tray is now ready for corrugated inner lid liner and timber lid.

▼ Packed tray with liner and part lid.



[Renwood

AN investigation in 1957 (1) determined suitable storage conditions and packing methods for maintaining Chinese gooseberries in excellent condition during long storage or for export. In particular, polythene case liners were found outstanding in improving keeping quality of the fruit and were much superior to wax-paper liners then in common use.

OVER the past three seasons all Chinese gooseberries exported to Britain and Australia were packed with polythene case liners.

The excellent and attractive condition in which the fruit has arrived overseas, packed in this way, has earned favourable comments and good returns, confirming the effectiveness of the method on a commercial scale. Nevertheless with a view to a possible reduction in packing costs, further work was carried out during the 1959 season with a better-quality wax-paper liner, used for packing export pears, to determine whether it was satisfactory for Chinese gooseberries.

The storage behaviour of the Monty variety of Chinese gooseberry, which had not been included in previous investigations, was also compared with that of the Bruno variety.

By W. A. FLETCHER, formerly Horticultural Advisory Officer (Citriculture), Department of Agriculture, Auckland, and B. M. PIPER, Horticultural Instructor, Department of Agriculture, Tauranga

Storage Conditions

The fruit was divided into three equal lots and packed in single layer export trays. One lot was packed with .0015 in. polythene liners, another with the type of wax-paper liner originally tested, and the third with the better-quality pear wax-paper liners. The packed fruit was then held in a grower's cool store for 18 weeks at 32 degrees to 34 degrees F and 90 to 92 per cent relative humidity.

(Continued at the bottom of next page)

Berry Fruit Plants Available from Levin

THE Department of Agriculture's Horticultural Research Station at Levin is offering for sale to registered nurserymen and commercial berry fruit growers a limited supply of strawberry, raspberry, and gooseberry plants.

THE varieties are: **Strawberry:** 'Redgauntlet', 'Talisman', and 'Merton Princess'; **raspberry:** 'Marcy'; **gooseberry:** 'Levin Early'.

Only small nucleus stocks are available and quantities will be supplied initially to each buyer as follows: 100 plants of each variety of strawberry and raspberry (price 28s. for strawberry and 50s. for raspberry) and 12 two-year-old plants (36s.) plus 25 rooted cuttings (30s.) of gooseberry. Buyers may order more than these quantities, and if additional plants are available after the initial distribution, they will be supplied on a pro rata basis.

Nurserymen and fruit growers who require plants this year must apply to offices of the Department of Agriculture for order forms, which with a description of plants will be available this month.

Acceptance of orders closes in April and orders must be placed on the form supplied. Full instructions for ordering plants are given on the order form.

Orders and payment for plants must be sent to the District Executive Officer, Department of Agriculture, Private Bag, Palmerston North.

Packaging Chinese Gooseberries

(Continued from previous page)

Immediately after removal from cool storage the fruit was examined, then transported from the Bay of Plenty to Auckland, and held for a further eight days at ordinary room temperatures, to simulate marketing conditions, before a final examination.

Results of Experiment

Though actual rots and rejects were slight in all treatments, there were significant differences in the degree of shrinkage and softening of sound fruits, both immediately after removal from cool storage and also eight days later, and there is no doubt that these differences would have been accentuated had the second examination been delayed a little longer than eight days.

These results show that though the better-quality pear wax-paper liners were superior to the original type wax-paper liners, they were still less effective than polythene liners, which again proved to be outstanding in maintaining the fruit in excellent condition.

Variety Differences

There was a slight tendency for the Bruno variety to shrink more than the Monty variety during storage, but differences in condition were not significant until eight days after removal from the cool store and then only where pear wax-paper liners were used. If the fruit had been held longer after cool storage, differences would probably have been more marked. Previously it had also been observed that Bruno was slightly inferior in keeping quality to the Abbott and Hayward varieties.

Conclusions

Though there appear to be slight differences in keeping quality between the main varieties of Chinese gooseberry, there is nothing to indicate that any of them cannot be held for more than four months in excellent condition, provided they are properly handled and stored according to recommendations made previously (1).

The cost of polythene liners is not much greater than that of pear wax-paper liners and the more attractive pack and outstanding results achieved with polythene liners seem to justify their continued use for export shipments of Chinese gooseberries.

Acknowledgment: Prew and MacLaughlin Ltd. for the use of their cool store.

References

(1) W. A. Fletcher, M. G. Baumgart, and B. M. Piper, "Handling Chinese Gooseberries for Long Storage and Export", "The New Zealand Journal of Agriculture", vol. 99, No. 1, July 1959, p. 15.

EFFECT OF DIFFERENT TYPES OF CASE LINERS ON THE CONDITION OF CHINESE GOOSEBERRIES COOL STORED FOR 18 WEEKS AT 32 DEGREES TO 34 DEGREES F

Type of liner	Mean shrinkage by weight Immediately after cool storage	 8 days later	Average of sound firm fruits Immediately after cool storage	 8 days later
	per cent	per cent	per cent	per cent
Polythene	0.4	1.6	99	97
Pear wax paper	3.3	5.2	90	85
Original type wax paper	4.6	6.5	83	81

Book Review

"Farm Animals": John Hammond

FOR 20 years John Hammond's "Farm Animals" has been the standard text in the teaching of animal science throughout the English speaking world. The appearance of a new edition of the volume bears more than adequate testimony to the fact that though he is now retired, Sir John has not been lost to the field of animal research and education. This, the third edition, is much enlarged on previous issues and brings us an up-to-date summary of present knowledge by a widely acknowledged master of the art of summarisation.

For crispness, clarity, and good English the book adds lustre to by far the greatest of writers in the field of animal production.

This volume will be welcomed by researcher, teacher, and student alike. It will also find its way to the bookshelves of our more enlightened farmers who add zest to their daily work by seeking all the knowledge they can get on the growth, reproduction, and inheritance of farm animals.

—*C.P.McM.*

Edward Arnold Ltd., London. 28s.

◆

Milling Quality of Hybrid Oats

TO estimate milling quality in the selection of improved varieties of milling oats a reasonably accurate small-scale quality test has been developed by the Cereal Section of the Crop Research Division, Department of Scientific and Industrial Research. This test has indicated that one of the hybrid oats produced by the Division, which is promising in yield and straw strength, is slightly inferior in milling quality to the standard variety, Onward. With the cooperation of oat growers and millers several acres of the hybrid has been milled in comparison with part of the growers' crops of Onward, and these full-scale trials have confirmed the results of the pilot tests.

Two further hybrids, one similar to Onward and one with improved agronomic characters, have been at least as good as Onward in pilot-quality tests, and seed is now available for sowing in full-scale trials. A definite improvement in the yields and milling quality of New Zealand oats may be achieved by the commercial production of one of these lines.

◆

Control of Ratstail

By J. E. BELL,
Fields Superintendent,
Department of Agriculture,
Auckland

RATSTAIL (*Sporobolus capensis*) is a tough, fairly vigorous growing grass with fibrous and unpalatable leaves. Once it gets a hold on hill country these characteristics make eradication almost impossible by stock management, by surface cultivation and oversowing, or by fire and fertiliser. However, the Department of Agriculture has proved in "chemical ploughing"* trials on dense infestations in Auckland Province that slow but sure kills can be obtained by spraying with dalapon at any time of the year at rates as low as or even less than 2 lb per acre.

RATSTAIL thrives in a fairly warm climate. It will grow on all kinds of soils, from poor sands to clays, and will compete with better grasses where fertility is fairly high. It can be fairly easily destroyed by ploughing, preferably after the top hamper has been burnt, and by subsequent cultivation during a cropping programme, but on areas where these methods cannot be used ratstail can get away, and much coastal and some inland rolling and hill country has been taken over by it.

Chemical Ploughing

The problem of eradicating ratstail caused the suggestion that chemical ploughing be tried for the first time in the Auckland district. Though it was thought that the method would be uneconomic because of the large amount of chemical that might be needed to destroy such a tough grass, Farm Advisory Officers of the Department laid down trials which thoroughly tested dalapon at rates of from 2 to 16 lb per acre, and amitrol at 1 to 8 lb, singly and in all combinations.

Ratstail can be satisfactorily controlled with dalapon at rates as low as 2 lb per acre. The kill at this rate is generally very slow but sure and is not harmful to the better species in the sward. Areas which have been sprayed should be topdressed and oversown with clovers.

Ratstail Very Susceptible

The trials showed that though ratstail is very tough in many respects, it is one of the grasses most susceptible to dalapon and amitrol; it is vulnerable at any time; and stage of growth does not matter much, but faster kills are obtained on short growth.

Details of Trials

Trials were started in autumn 1958 by Farm Advisory Officers at Thames and Pukekohe. At Thames it seemed after 16 months that 5 lb of dalapon plus 2 lb of amitrol would be needed to kill the ratstail, but in another three months it was clear that the lowest rate of dalapon, 2½ lb per acre, was successful and was as effective as 5 lb. The officer at Pukekohe had to wait a year to get a 100 per cent kill from 5 lb of dalapon per acre, the lowest rate he used. Previously, about seven months after the trial was started, he had decided that the trial was a failure.

In spring 1958 a trial was laid down in the Auckland district in which amazing results were obtained from the lowest rate of chemical, 2½ lb of amitrol, which killed almost all the ratstail in a dense infestation. Only heavy rates of dalapon were used in this trial. Next autumn the same treatments had similar results despite the dense cover of paspalum.

The paspalum also was affected, and apparently time of application would depend on whether or not it was desired to reduce the paspalum in the sward. The dense, dead top hamper of autumn vegetation after treatment makes introduction of other species very difficult.

Further Trials

From the autumn of 1959 a number of trials were laid down throughout the year, and further trials, some of which are on a field scale, have been laid down.

Near Hamilton trials begun at intervals of six weeks indicated that time of application of 5 lb of dalapon per acre had little effect on results.

At Dargaville and Pukekohe spectacular results were obtained from 2 and 2½ lb of dalapon.

A recent trial on One Tree Hill, Auckland, shows that lower rates than 2 lb may be effective. In this trial even ½ lb per acre has produced worth-while results, but it appears that at least 1 lb per acre will be needed to obtain a kill of over 95 per cent. The trial was laid down in autumn 1960 on a ratstail-infested hillside and the tentative results will have to be confirmed by further trials.

A trial to find out how much dalapon was needed to obtain a quick knockdown of ratstail, preparatory to cultivation for cropping, showed that far too many uneconomical doses of the chemical were needed for such a project to succeed.

A trial with dalapon mixed with superphosphate for topdressing by air or otherwise indicates that at least 5 lb of dalapon mixed in superphosphate is needed to obtain any kill at all, and for satisfactory results 10 lb may be required. This trial is not yet concluded.

What Trials Showed

In the trials both dalapon and amitrol killed the ratstail, but dalapon gave the best and most consistent results, with least damage to other

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* Destruction of the plant cover by chemicals followed by sowing without cultivation

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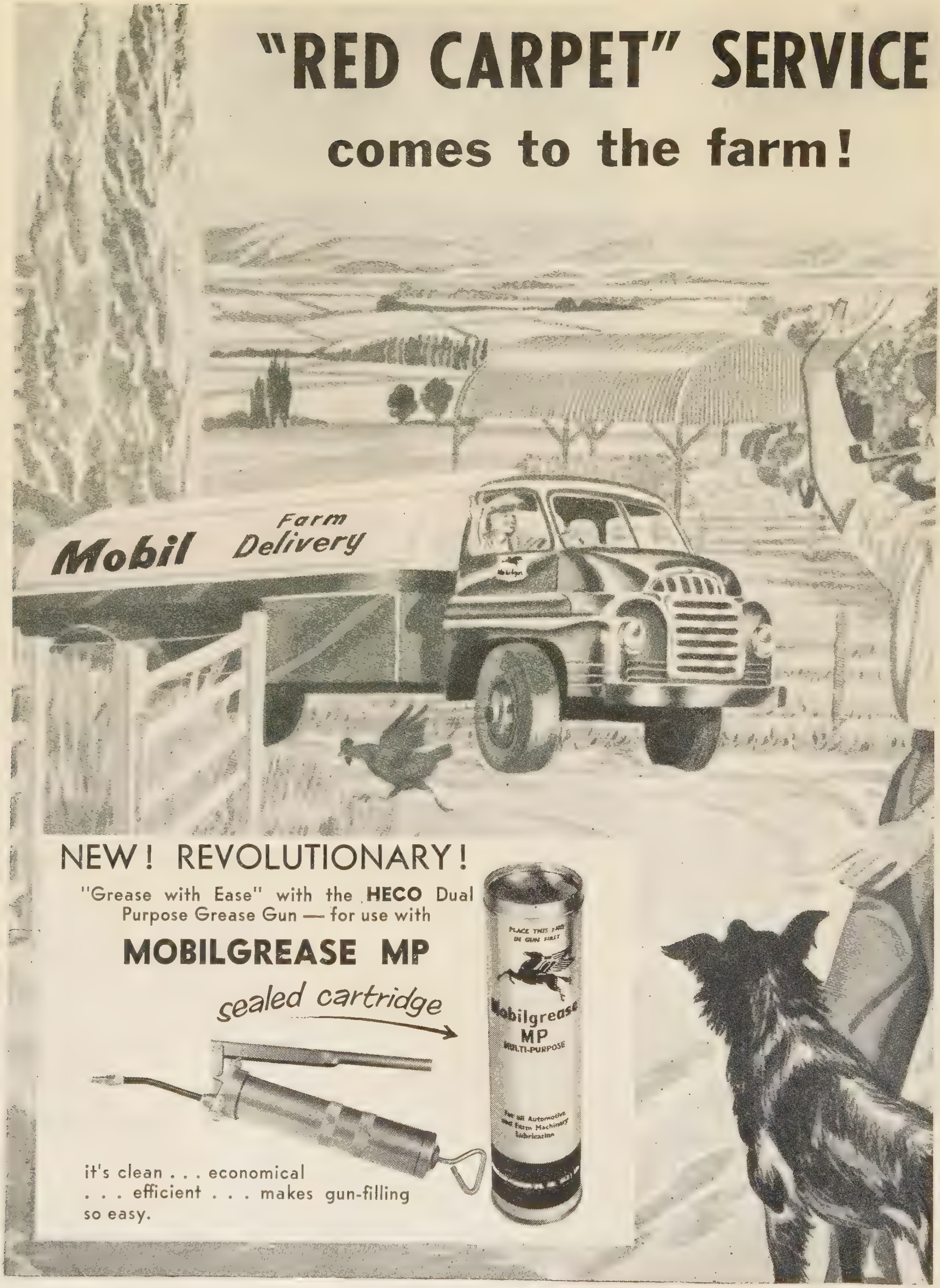
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species. The addition of amitrol to dalapon gave no advantage.

The materials were sprayed on with enough water to wet the foliage with a minimum of run-off. However, worry about run-off with dalapon seems unnecessary, because as good a kill was obtained on a portion of one trial where there was a torrential downpour immediately after the dalapon was applied.

Also, in another trial on a paspalum-ratstail sward where the paspalum overtopped and protected the ratstail leaves to a great extent from the spray, the kill was equally good from the dalapon and the amitrol as from an early spring application when the ratstail was not shaded and protected.

It appears, therefore, that much of the kill is caused by root absorption. Good kills were obtained with the lowest rate of dalapon used, 2 lb per acre. If only thinning out of the ratstail were required, still lower rates would suffice, but the stage of growth and amount of run-off may then prove critical.

Higher rates gave a quicker kill but caused more damage to the sward and the oversown species. Heavy rates such as 8 and 16 lb of dalapon were especially damaging, with poisonous effects on the soil lasting for a year or so; also the first plants to appear on the bare ground were likely to include ratstail seedlings.

Hence, even if the dalapon cost the farmer nothing, it would usually be advisable for him to use it at rates as low as 2 or 3 lb so that good species are not affected much and seedlings from oversowing are not destroyed.

Though it is difficult to establish ryegrass and cocksfoot from oversowing, clover establishment is not so hazardous and clover seed should be sown where clover is not present.

Adequate topdressing is certainly necessary, so that a good sward cover is obtained to get production and to ensure that ratstail seedlings do not take hold again.

Where light rates of dalapon were used the kill was very slow, and since the better species were not affected much, these soon expanded to replace the ratstail as it gradually disappeared. Kills were so slow that an early trial referred to previously was abandoned as a failure, but a chance visit later showed a 100 per cent kill from the lowest rate tried, 5 lb of dalapon per acre.

In one or two of the trials Farm Advisory Officers reported that three months or so after treatment the ratstail was putting out fresh shoots and was bound to recover. Yet in 12 or 18 months' time 100 per cent kills were obtained.

Summary

1. Ratstail can be destroyed by spraying it with dalapon at 2 lb per acre at any time of the year and less than this may suffice.
2. The kill is generally very slow but sure.
3. Sprayed areas should be topdressed and oversown with clovers where necessary.

◆

Simple and Efficient Method of Disposing of Offal

A SIMPLE and effective method of disposal of farm offal used on the farm of Mr G. M. Wall of Pukerua Bay, near Wellington, is illustrated. A completely dog proof pit was constructed on the side of a gently sloping bank and a stout fence put round the whole area.

THE pit is 6 ft 6 in. long, 3 ft wide, and 9 ft deep. Round the top edges of the pit the topsoil has been removed and replaced with a wooden frame rather like a door jamb laid horizontally. An old shed door was used for a lid, but one could be made from good seasoned timber so that there is no shrinkage, as the lid must be a good fit.

The principle of the pit is that bacterial action breaks down the solids into harmless liquids which seep away through the subsoil. Concrete could be used round the top as an extra support for the lid if required. The lid is kept over the pit and need be opened only when offal is thrown in.

Mr Wall estimates that it will be many years before the pit fills, if it ever does, as the bottom was only just covered after over a year's use.

Such a pit should be somewhere near airtight, on the side of a bank so that rainwater can drain away and not seep into it, and adequately fenced so that stock and dogs cannot get at it. It should be kept locked to safeguard children.

—J. D. TENQUIST,
Livestock Instructor,
Department of Agriculture,
Wellington

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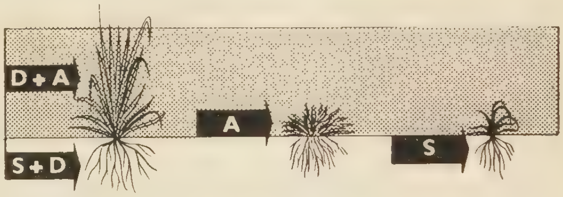

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Repeat Test of

Dehydrated Lucerne Meal as Source of Vitamin A for Laying Pullets

By J. EDMONDSON, Poultry Experimentalist, Department of Agriculture, Upper Hutt, and F. C. BOBBY, Chief Advisory Officer (Poultry), Department of Agriculture,
Wellington

A REPORT of work at the Department of Agriculture's Poultry Demonstration Plant at Upper Hutt in the "Journal" of October 1959 indicated clearly that good-quality lucerne meal was a satisfactory source of vitamin A, and this has been confirmed by a subsequent test reported on here.

Lucerne Meal Good Source of Vitamin A

The feeding trial reported here supports work previously reported showing that vitamin A requirements for laying pullets were adequately met when 4 per cent of good-quality dehydrated lucerne meal was added to the diet, when compared with a ration to which no lucerne was added but which was fortified with the requisite amount of vitamin A. Yolk colour was greatly superior with a diet containing lucerne meal, but the meal must be of good quality and high in carotene content before it can be relied on as a source of vitamin A for laying pullets.

THE New Zealand housewife demands eggs with reasonably rich-coloured yolks, even though such eggs are in no way superior nutritionally to paler ones. To meet this requirement for yolk colour poultry farmers commonly use rations containing first-quality dehydrated lucerne meal. Four per cent in the diet of a laying bird is adequate.

Though good-quality lucerne meal has become popular mainly because it is rich in the pigments required for good yolk colour, its being a rich source of vitamin A, in the form of carotene, is probably not so well appreciated. This should be considered when a mash is formulated, as the contribution of carotene (provitamin A) from lucerne meal will reduce the amount of additional vitamin A needed to supplement the diet.

Method of Testing

Two groups of 80 White Leghorn x Australorp pullets at point of lay were used. They were housed intensively, each group of 80 birds being divided into two pens of 40. Egg production, food consumption, and mortality were recorded for 40 weeks. Group 1 received a mash with 4 per cent of lucerne meal and without added vitamin A; Group 2 were fed a similar mash but with the lucerne meal omitted and fortified with vitamin A at the rate of 4,000 international units per pound. Mash ingredients were as follows:

MASH INGREDIENTS

	Group 1 Added lucerne meal	Group 2 Added vitamin A
	lb	lb
Ground wheat	800	800
Ground maize	200	200
Ground barley	400	400
Ground oats	100	100
Meat meal (60 per cent)	224	224
Milk powder	80	80
Oyster shell dust ..	46	46
Salt	10	10
Manganese sulphate ..	¼	¼
Pollard	60	140
Dehydrated lucerne meal	80	—
Vitamin A	—	+
Vitamin D_3 and riboflavin	+	+
	2,000¼	2,000¼

The above "all mash" rations were available to the birds at all times; limestone grit and hard (insoluble) grit were fed free choice.

Cost of Mash

Mash was costed on a basis of average ruling prices of ingredients. No charge is included for cost of mixing or of transportation to the farm. Such charges are common to both groups and consequently do not influence comparisons made between groups.

Results of Trial

Results of the feeding trial are summarised in the table at right. As this test is, in fact, complementary to that reported earlier, the relevant 1959 figures are shown in brackets beside the results from the present trial. This will enable comparisons to be made easily between the two trials and will influence conclusions drawn.

Egg Production

Measured over 40 weeks from point of lay a "hen housed" average of 169 eggs for both groups (160 and 162 respectively for Groups 1 and 2 in the previous test) indicates a reasonable rate of lay with no difference between groups.

Efficiency of Food Conversion

Comparison of food conversion efficiency, measured by the amount of food consumed for each dozen eggs produced, showed very little difference between either group in both tests. The present test gave a difference of .02 lb efficiency in favour of the lucerne group, whereas the previous test showed a difference of .08 lb in favour of the vitamin A group.

Economic Efficiency

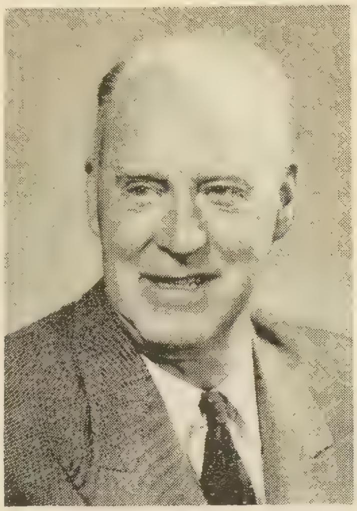
Economic efficiency, measured as the cost of food required to produce a dozen eggs, reflects a combination of the cost of mash, egg production, and efficiency of food conversion. Where

(Continued at foot of page 296)

RESULTS OF TRIALS

	Group 1 Added lucerne meal		Group 2 Added vitamin A	
	Present test	Previous test	Present test	Previous test
Cost of mash per ton	£28 16s. 6d.	(£28 3s.)	£28 11s.	(£28 4s. 8d.)
Food per dozen eggs ..	5.45 lb	(5.47 lb)	5.49 lb	(5.39 lb)
Cost of food per dozen eggs	18.85d.	(18.31d.)	18.81d.	(18.32d.)
Average per cent production	63	(58)	65	(59)
Average eggs per bird (40 weeks)	169	(160)	169	(162)

Term of Service Extended



Mr P. W. Smallfield, Director-General of Agriculture, whose term of service has been extended for a year. He was due to retire after 40 years' service on 31 March.

Lucerne Meal for Pullets

(Continued from page 295)

these separate items are similar for both groups there would be no marked difference in economic efficiency. The cost of food consumed per dozen eggs produced was 18.85d. in the lucerne group and 18.81d. in the vitamin A group (18.31d. and 18.32d. in the previous test).

Vitamin A Reserve

Livers from six birds in each group were examined to find the vitamin A content. Group 1 (lucerne meal) gave an average assay of 447 international units of vitamin A per gramme compared with 122 international units for Group 2 (added vitamin A). The previous test showed 370 international units per gramme for the lucerne group and 136 for the added vitamin A group.

The lower levels of vitamin A revealed by liver assay are more than adequate and indicated that the birds were receiving enough of this vitamin.

Yolk Colour

Previous tests have repeatedly demonstrated that 4 per cent of first-quality lucerne meal gives yolk colour that is acceptable in New Zealand, and the feeding trials reported here support this finding. Group 1 of both trials gave eggs with good yolk colour, while Group 2, without lucerne meal, gave eggs with pale, insipid yolks of the type severely condemned by the housewife.

Wintering the Dairy Herd

ABUNDANT experimental evidence is available to show that the level of feeding during winter when the cows are dry is of considerable importance in determining the level of yield in the following lactation. Dry cows should be well fed so that body weight and reserves are built up before calving.

At the start of the milking season pasture feed is usually highly nutritious, but freshly calved, high-producing cows are quite incapable of consuming sufficient of it, even when allowed unrestricted grazing. At this time cows can achieve high yields only by drawing on body reserves and if these reserves are lacking, milk production suffers. Cows which have calved in good condition can withstand a short period of moderate underfeeding without loss of production.

Importance of Condition of Animals

There are many different management systems of wintering cows satisfactorily, but provided the feed is nutritious, the nature of the feed stuffs does not matter very much; condition of the animals at calving is important. Only when cows are wintered on hay or silage alone, without any grass pickings or supplementary feed, is it extremely difficult to build up condition.

Work at the Department of Agriculture's Ruakura Animal Research Station has shown that butterfat production can be maintained in autumn when the herd is fed only small quantities of grass supplemented with good-quality silage. It is therefore poor practice to waste large quantities of highly nutritious autumn-grown pasture by feeding it to cows that are producing at a relatively low level near the end of lactation; instead the policy should be to spell as large a proportion of the farm as possible in late April and May. To do this when the herd is still milking, it is usually necessary to start feeding out early and to save the high-quality pasture feed for use before and after calving.

—*J. A. GRAHAM,*
Instructor in Agriculture,
Department of Agriculture,
Palmerston North

Cereals for Green Feed

RYECORN, especially the new C.R.D. selection, is an excellent cereal for green feed because of its good growth and recovery after grazing. Seed from surplus crops is also always in demand.

Oats do not have the same recovery powers as ryecorn, but are valuable feed and can later be saved for grain or cut for hay or silage before ripening. In some districts oaten sheaf stacks are kept for possible use as chaff in a severe winter.

Malting Varieties of Barley

Malting varieties of barley such as Kenia and Research which are sometimes sown as a green feed have the advantage that they establish rapidly and their growth is extremely palatable. Recovery growth from the malting barleys, however, would not provide as much feed as, say, ryecorn or oats, and the crop could not be retained for a grain harvest later. Cape barley and Black Skinless barley are used only to a limited extent as a green feed.

Improved prices for wheat have made this crop more popular, especially since development of the new heading varieties Aotea and Arawa, which can produce good green feed after autumn sowing and follow with a good yield of grain.

Healthy Seed Should be Sown

A good range of selected types of cereal varieties for varying conditions of soil and climate is available. Healthy seed from vigorous strains properly treated for disease control should be sown.

Weed control is important in cereal crops. Those to be saved for grain after use as a green feed can be sprayed with hormones to reduce weeds, especially Californian thistle, before the area is sown out to permanent pasture.

—*W. A. LUNN,*
Fields Instructor,
Department of Agriculture,
Ranfurly

Ornamental Use of Fruit Trees and Vines

By J. S. SAY,
Horticulturist, Department of Agriculture, Auckland

STRIKING features of many flower gardens in the warmer districts during winter and spring are citrus trees used as ornamentals. They are no longer relegated to the back garden, but are brought forward to make a bold splash of colour when gardens tend to be drab and uninteresting.

MANY other kinds of fruit trees can be grown also as ornamentals and with the small town sections of today this often becomes a necessity if it is desired to grow at least some of the household needs of fresh fruit and fruit for jams and preserving. On farms, where the problems of space are not so pressing, larger trees such as pears, cherries, walnuts, mulberries, and avocados may be grown outside the confines of the garden to provide a background to the homestead.

[*Sparrow*

▲ The bold foliage of mountain pawpaws gives a tropical appearance to many gardens in warmer districts. A hermaphrodite plant bearing bunches of small fruit is shown.

Fruit trees and vines brought into the ornamental part of the garden may be the well known types such as apples and peaches and some of the more unusual kinds like avocados and cherimoyas used purely as ornamentals.

Specimen and Shade Trees

A specimen tree is usually planted so that it is a focal point in the garden. It should have a good shape and form and, if possible, attractive foliage, flowers, and fruit.

Citrus trees have all these characteristics and make excellent specimens.

Among the more unusual types, some of which are described on page 301, avocados make beautiful specimen trees, though they may grow too large for the average home garden.

Fruiting apples, peaches, plums, etc., while not as spectacular as most of the types grown solely for their flowers, could well be used where the latter would normally be planted. Varieties of peaches with bronze foliage and peaches and nectarines with weeping habits are available and make good specimens. Pears, cherries, and walnuts are too large for the average town section and as the first two usually need cross-pollination two or more have to be planted.

With a little care a suitable shade tree can usually be selected even for the smallest garden. Most of the deciduous fruit trees are excellent for the purpose, but may need pruning and training to give a high standard and a more spreading top so that there is plenty of room underneath.

Walls, Fences, and Pergolas

Apples and pears may be trained as cordons and espaliers and peaches as fans against walls and fences. Trees grown in this way take up little space and give very high yields. Chinese quinces (*Chaenomeles sinensis*) make first-class wall shrubs. Though they are usually grown for their early flowers and autumn colour, their large aromatic fruits are spectacular and make delicious jelly. Figs can be used as wall shrubs, but are rather too vigorous for limited areas. Red currants and gooseberries can also be used in this way.

Fruiting vines can be used for climbing plants for walls, trellises, and pergolas. Grapes, passionfruit, and Chinese gooseberries all have their

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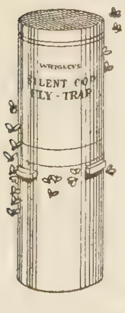

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Shade Trees

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Specimen Trees

Shade trees as above. Citrus, avocado, cherimoya, casimiroa, macadamia (Queensland nut), litchi, banana, pawpaw, tree tomato.

Walls and Fences

Trees and shrubs as espaliers, cordons, etc.

Apple, pear, quince, peach, apricot, red currant, fig, gooseberry, Morello cherry.

Climbers

Chinese gooseberry, passionfruit, grape.

Hedges

Feijoa, guava, cranberry, hazel nut, pomegranate, Kei apple.

Bold Foliage Effect

Monstera, loquat, fig, banana, pawpaw.

Autumn Colour

Persimmon, Spanish chestnut.

Colourful Fruit

Citrus, persimmon, loquat, passionfruit, pomegranate, tree tomato, coffee (glasshouse only).

Flowers

Pip and stone fruit, citrus, loquat, pawpaw, passionfruit, feijoa, hazel nut, banana.

Shrub and Mixed Borders

Citrus, guava, feijoa, dwarf apples, pomegranate, hazel nut, gooseberry (as standards).

Tub Plants

Citrus, dwarf apples, banana, pawpaw, monstera, fig, kumquat, pineapple.

House Plants

Citrus, banana, pawpaw, monstera, pineapple.

uses, though the last are too vigorous for small areas unless they are skilfully but severely controlled during the growing season.

Dwarf Trees

Apples budded on a dwarfing stock and growing to about 4 to 5 ft are very ornamental and bear heavily. They may be grown as bushes, pyramids, espaliers, or cordons and can be fitted into the smallest garden. When grown in the open garden they must be staked securely, as they have rather poor root systems. Pears budded on to a dwarfing quince stock are available, but though they are very much less vigorous than normal trees, they are not dwarfed to the extent of the apples. They are suitable for medium gardens, but two or more must be planted for cross-pollination.

Hedges and Borders

Hedges give shelter and privacy but waste a good deal of ground. Feijoas and guavas make very good informal or semi-formal hedges and bear good crops. Cranberries (*Myrtus ugni*) and dwarf pomegranates make good low hedges. Cranberry fruit is very small, but can be used for jelly. In cold districts hazel nuts can be used. The catkins in spring are very attractive.

Smaller growing fruit trees such as mandarins on trifoliata stock, feijoas, guavas, pomegranates, and dwarf apples are well worth a place in shrub and mixed borders.

Ornamental Foliage and Fruit

Plants with large, bold foliage blend well with modern architecture, especially bananas, figs, pawpaws, loquats, and monsteras, which can be planted about the bases of these buildings and in boxes which are often incorporated in the design.

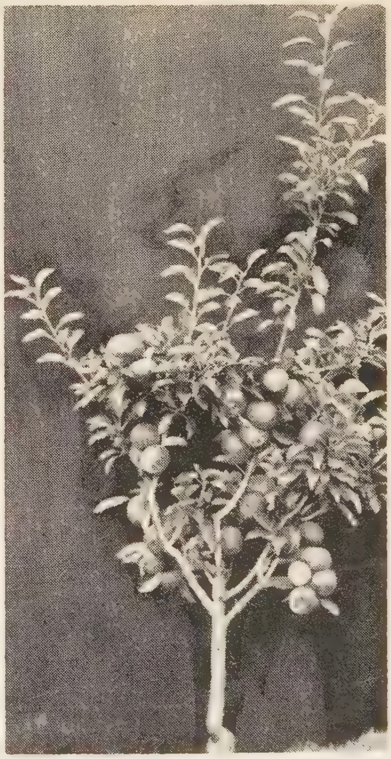
In warmer districts where there is little good autumn colour persimmons usually make a brilliant show. The fruits, too, are very colourful and frequently remain on the tree well into winter, and even if they are not liked for eating are well worth growing for their colour. Loquats, in addition to good foliage, have scented flowers in winter which are quite attractive. They are followed by golden yellow fruit in late spring.

Tub Plants and House Plants

Few flower gardeners realise the value and usefulness of tub plants. They may be used as specimens or to furnish patios, entrances, and outdoor living areas. They are useful for positions where normal planting is not possible and for temporary screens. They can be brought into prominence when most attractive and moved away again later.

Dwarf apples make delightful tub plants which always attract a great deal of attention when in flower and fruit. Citrus, especially some of the smaller varieties, are among the best of tub plants, for their dark green leaves are always attractive and when well covered with fruit can make a spectacular show. Kumquats (*Fortunella* spp.), which bear fruit like miniature mandarins, are worth growing for their colour and flowers. The fruit are generally inedible. Other

Dwarf apple trees in flower and fruit.



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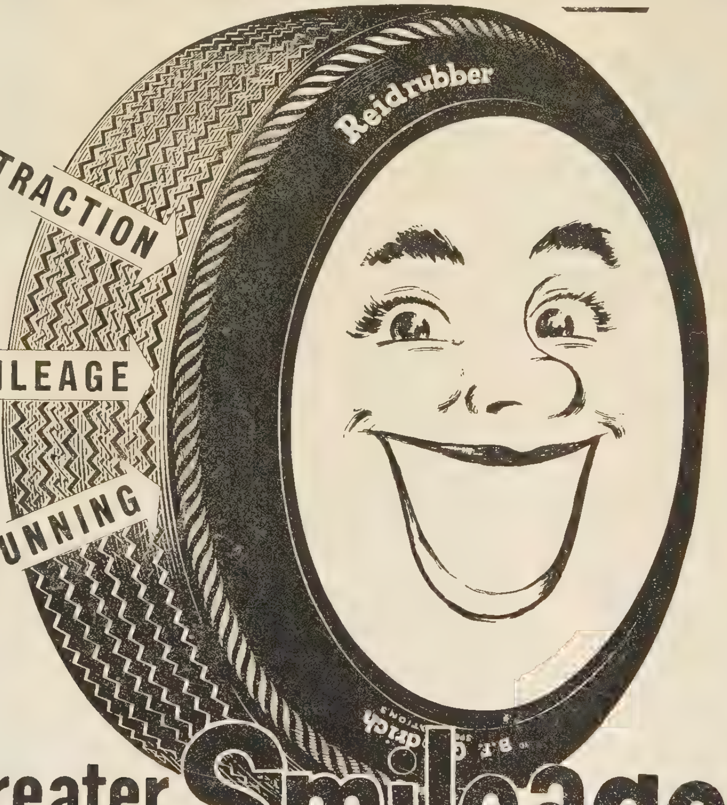

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[*Sparrow*

The red-flowered banana passionfruit *Passiflora van volxemii*. Inset is the very long flower stem.

[*Sparrow*

Avocados make beautiful specimen and shade trees. The shining foliage has a bronze tinge when young and turns a good dark green when mature. Inset is a section of fruit.

suitable fruiting plants are mountain pawpaws, bananas, monsteras, figs, and pomegranates.

A few, including bananas, pawpaws, pineapples, and citrus, make good house plants. The first three are fairly well known, but citrus are almost completely neglected as house plants. The perfume from the flowers is delightful, and even quite small plants will bear fruit.

Unusual Fruits

A number of tropical and subtropical fruits are now available commercially, but with the exception of mountain pawpaws are still in very short supply. Most of them are well worth growing as ornamentals, but as their fruits become better known and appreciated they should become more popular. The following are in New Zealand, and, in general, grow well provided climate and soil are suitable, though some do not fruit satisfactorily.

Avocado

Avocado (*Persea americana*) is a native of Central America and is related to the camphor laurel which is a very popular ornamental tree in Auckland. (The names avocado pear and alligator pear are not now used.) It grows to about 40 ft and has a dense, compact habit. In spring the young leaves have a distinct bronze tinge, but turn a dark green when mature. The fruits, which ripen in winter and spring, are large and somewhat pear shaped and are used mainly for salads and sandwich spreads.

Seedlings bear in about 11 years and grafted plants in five to six years. They sometimes have a tendency to biennial or triennial bearing.

A light, free draining soil is best, for they are susceptible to phytophthora root rot on heavy, poorly drained soils. Hardiness is about the same as that of lemons. Little is known about varieties most suitable for New Zealand conditions, but Fuerte and Nabal do well in Gisborne.

Casimiroa

Casimiroa edulis (white sapote) belongs to the citrus family and comes from Mexico and Central America. It should not be confused with the true sapotes or sapodillas, which will not grow in New Zealand. It is not particular about soil and is slightly more tender than citrus. The leaves are compound, the largest leaflet being about 8 in. long and bright green. It is semi-deciduous and grows to about 20 ft. The fruits, ripening in March to April, are about 3 in. in diameter with rather large seeds. The flesh, usually eaten with cream and sugar, is sweet and buttery and extremely nutritious with high vitamin A and C content. Seedlings are very variable, but some selected varieties are now available.

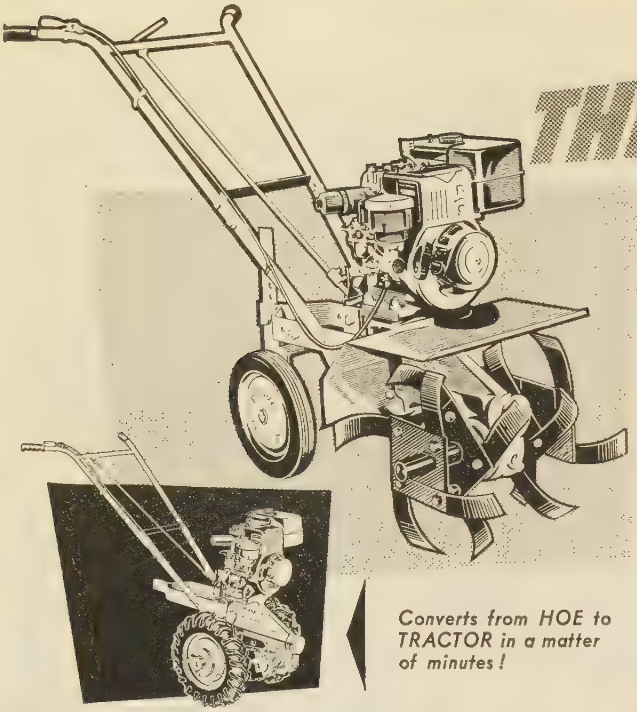
Cherimoya

Cherimoya (*Annona cherimola*) comes from Peru and is about as hardy as tree tomatoes. It is sometimes incorrectly known as custard apple, a name of another annona species which is not in New Zealand as far as is known. Height is about 15 ft with a rather spreading habit. The leaves are oval and about 5 in. long. It is semi-deciduous, losing many of its leaves in spring. The fruits are about 3 to 4 in. in diameter with a thin skin appearing to consist of overlapping scales. The flesh is sweet and has a buttery consistency with large seeds embedded in it.

New Zealand is not quite warm enough to produce the distinctive flavour and the flowers should be hand pollinated to secure a heavy crop. It crops in about five years and several named varieties are available in New Zealand.

Queensland Nut

Queensland nut (*Macadamia integrifolia*) belongs to the same family as proteas and banksias and is about as



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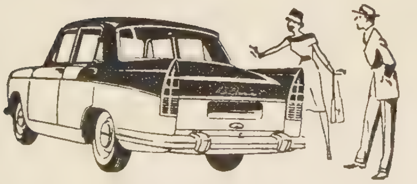

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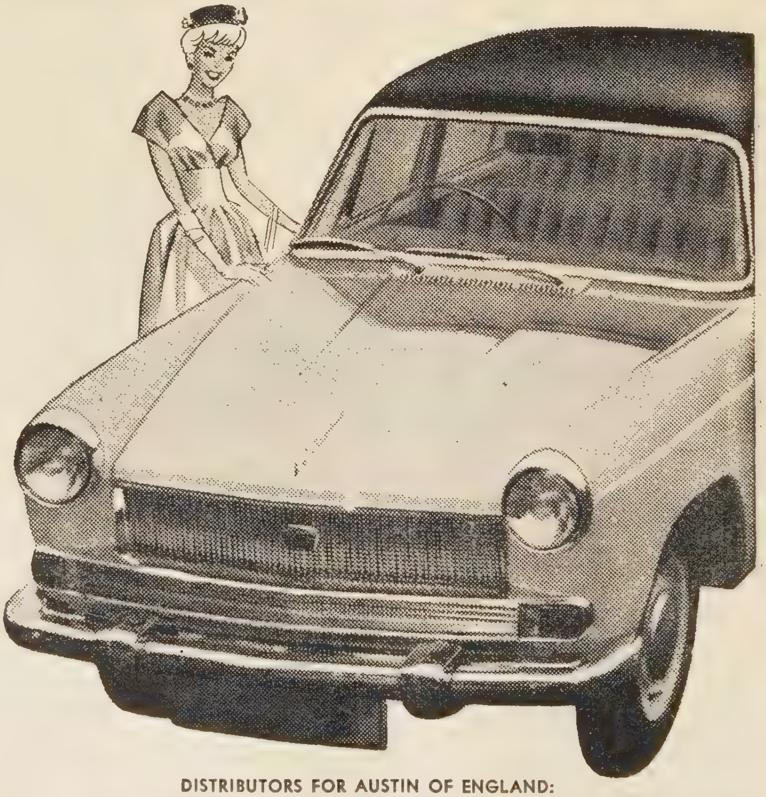

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hardy as citrus, once established, but is very tender in the young stages. It does not transplant easily and only pot grown plants should be bought. It is fairly tolerant of heavy soils. The leaves are about 9 in. long and 1½ in. wide, hard and stiff with a serrated edge. The growth habit of seedlings is variable, being upright or spreading. Height in New Zealand is about 15 to 20 ft, but up to 50 ft in Queensland. The nuts, which ripen throughout the year but mainly in winter, are often considered to be the most delicious there are. The main drawback is that the shells of most varieties are extremely hard. A number of varieties are in New Zealand but are not available commercially yet. Seedlings take about 10 years to fruit, but grafted varieties should not take so long.

Bananas

Several types of bananas are available in New Zealand. Some have edible fruit, but others are grown as ornamentals. The Abyssinian banana (*Musa ensete*), grown only for ornament, is larger and hardier than the edible kinds. The fruits, which are borne in about seven years, are finger sized and packed tightly on the stalk. They are full of hard seeds which germinate readily if sown when fresh. This species does not sucker.

A number of edible kinds are available in New Zealand, but the naming seems to be rather confused except for the Cavendish variety, which makes an excellent tub or pot plant. This grows to about 5 ft and has large leaves which are reddish when young. It seldom fruits in Auckland. Some of the other edible kinds grow to 10 to 15 ft and produce large fruit, after which the old trunk dies but suckers spring up from the base. The flower head should be cut off once all the fruit (usually about five hands in New Zealand) have set.

Olives

Probably the first planting in New Zealand of olives (*Olea europaea*) was made about 90 years ago in what is now Cornwall Park, Auckland. Many of the trees are still growing and healthy. Unfortunately they were a poor variety and have never cropped satisfactorily. Olives will grow on poor, stony, dry soil and will stand up to 17 degrees of frost, but are a little more tender when young. They have a greyish foliage and with age become gnarled and twisted, which gives them a character all of their own. They are trees which could be grown more on difficult, rocky soils. A number of varieties are in New Zealand, some commercially, but none is a really satisfactory cropper. Mission has been the best in Hastings, but its crop is very light compared with overseas production.

Bananas may be grown as ornamentals in frost-free districts.

Passionfruit

The common purple passionfruit (*Passiflora edulis*) is well known, but there are several other species generally grown for ornament rather than for fruit. *P. mollissima*, the pink flowered banana passionfruit, is hardier than *P. edulis*, but the quality is not so good. *P. van volxemii*, also called banana passionfruit, is not as hardy as *P. mollissima*, but the quality of the fruit is usually better, but not as good as *P. edulis*. The flowers are red and hang down on thin stems up to 15 in. long. *P. ligularis* is very vigorous and has leaves about 12 in. long by 9 in. wide. The flowers are light blue, but rarely set fruit in New Zealand. The fruit is large, hard, buff coloured, and sweet, but does not have much flavour.

Pawpaws

The true pawpaw (*Carica papaya*) is very tender and almost impossible to grow in New Zealand. The mountain pawpaw (*C. candamarensis*) grows well in areas which are frost free or have only light frosts. They are very ornamental plants with large, bold leaves, often up to 18 in. across. Male and female flowers may be borne on separate trees, though many plants will produce both (hermaphrodite).

If fruit is wanted, several plants should be put in to ensure that at least one of each sex is obtained. The female bears fruit up to 5 in. long, singly or in pairs. The hermaphrodite has much smaller fruit that is deeply ribbed and borne in bunches. The flowers are strongly scented and the fruit is very aromatic. The flesh and seeds may be eaten. The flesh is rather tough. The fruit may be stewed and used in pies and can also be used for tenderising meat.

Pecan

Pecan (*Carya oliviformis*) is related to the walnut and comes from Texas. Though it grows well in New Zealand, forming a large tree 40 to 50 ft high, it does not fruit satisfactorily, possibly because the climate is not dry enough. It sometimes colours well in autumn.

Litchi

Litchi (*Litchi chinensis*), a native of South China, is in New Zealand, but probably is not commercially available yet. It is very tender in the young stages and tolerant of wet soils, except in winter. It is an ornamental small tree, evergreen, round topped, with orange or coppery-red young growths. The fruit, about 1½ in. in diameter, consists of white flesh round a large seed, but it rarely sets in New Zealand. The flesh is gelatinous, sweet, and pleasant. It is very difficult to propagate.

Guava

The red and yellow varieties of guava (*Psidium cattleianum*) are well known, but the true tropical guava (*P. guajava*) is not so common. It makes quite an attractive shrub and will stand light frosts. The fruit lack flavour and are not particularly pleasant when fresh, but quite enjoyable when cooked.

Kei Apple

Kei apple (*Dovyalis caffra* or *Aberia caffra*) is a very thorny shrub from South Africa. It grows to about 10 ft and is used in some countries as stockproof hedges. The fruits are yellow, about 1 in. in diameter, very acid, and are used mainly for jams and pickles. Male and female flowers are borne on different plants.

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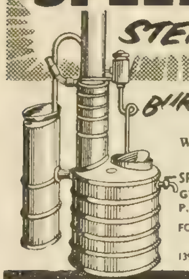

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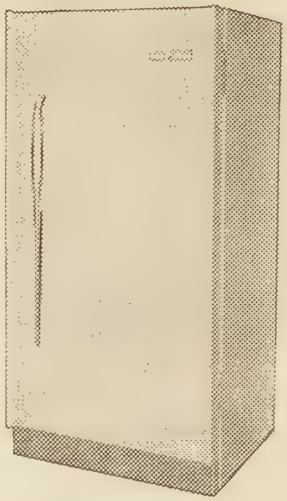

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Garden Work for April

Planting

Complete the planting of winter and spring flowering bedding plants as soon as possible. As the soil is colder, growth will not be as good as from earlier planting, so closer planting is advisable in the colder parts of the country.

Plant evergreen trees and shrubs before the soil becomes too cold. Though in Auckland and elsewhere in the north evergreens can be planted throughout winter, the most favourable planting time is in late autumn or very early spring. Root growth is then active so that plants establish quickly in the new soil. In cold soil the reduced root system will not be sufficient to maintain the large leaf area through winter, and the shrub may become desiccated and die back. Planting in early April or late August and cutting back some of the top growth will cause the least check to transplanted evergreen and frost-tender shrubs. They should be wrenched about six weeks before they are transplanted. Plant deciduous trees and shrubs as soon as the leaves begin to fall.

By JOY WATKINS,
Horticultural Advisory Officer,
Department of Agriculture,
Auckland

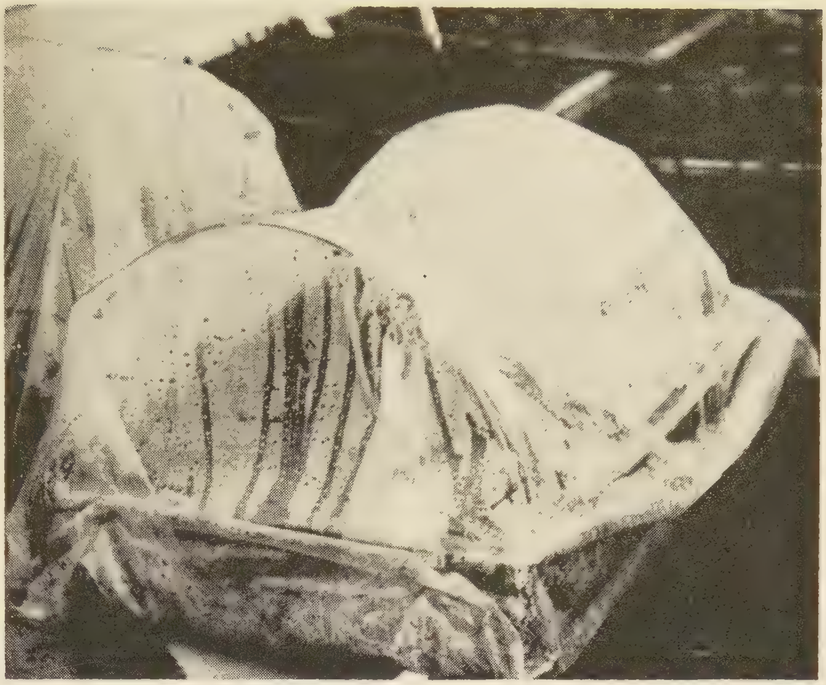
Propagation

Take hardwood cuttings of shrubs such as fuchsia, ribes, forsythia, abelia, pittosporum, hebe, tweedia, and senecio. Deciduous varieties can be rooted in well drained open ground. Peat or leaf mould and coarse river sand or scoria can be mixed into the soil before cuttings are inserted. Most evergreen hardwood cuttings root better in a frame. A pot covered with plastic or a box covered with a sheet of glass is an adequate substitute for a frame.

To prepare hardwood cuttings take current season's growth, remove any soft tip, and cut to 6 to 9 in. long with a sharp knife so that the base is cut immediately below a bud. Remove leaves from the lower half of an evergreen cutting.

Many native plants such as pohutukawa, which flower during summer, are now ripening their seeds. These should be gathered from the plant and sown when the seed case is still green.

METHOD OF STRIKING CUTTINGS



A method of striking small cuttings. They are inserted in sandy soil in a seed box and covered with a sheet of polythene which is supported by two arched wires.

Germination is much slower if the seed is allowed to become fully ripe and dormant. Seeds of pohutukawa and possibly some other native plants should not be sown in the usual seed mixture, but in poor soil. They germinate very well on the surface of clay if this is kept moist and shaded.

Routine Work

Clean up the garden for winter, as the ground will soon be too wet for easy hoeing and weeding.

Cut down herbaceous plants to ground level. Divide and replant those which are overcrowded, discarding any diseased or weak old portions. Before replanting divisions, remove weeds and mix compost and a little fertiliser containing phosphates and potash (bone meal and sulphate of potash) into the soil.

Fork over the ground between herbaceous plants and shrubs to remove weeds and to break up the surface to allow water and air to penetrate. Forking must be very shallow (only about 2 in.) to avoid damaging surface roots. If the border has been mulched, there is no need to fork it over unless the mulch has been trodden and has packed down.

Stake and tie shrubs in exposed positions, particularly those such as cassia with poor root systems or such as poinsettia with long branches.

Apply a fertiliser mixture of 3 parts of sulphate of ammonia to 1 part by weight of superphosphate to lawns. Monthly applications of ½ oz to the square yard from April to September produce a better sward than 1 oz to the square yard every three months, at least in those parts of the country where lawns continue to grow throughout winter.

Dig over vacant ground, incorporating compost. If lime is to be added, it should be applied to the surface immediately after digging so that winter rains will wash it in. Agricultural lime is suitable. If the ground is not required until spring, the opportunity should be taken to build up the organic content by sowing a green manure crop such as lupin, ryecorn, or prairie grass. About 1 lb to 80 sq. yd. of seed is required, or 1 bushel to the acre.

Replenish the compost heap with non-seeding annual weeds, hedge clippings, lawn mowings, and the tops of herbaceous plants. Untreated sawdust will increase the bulk. An activator is necessary to accelerate decomposition during winter. Poultry or other animal manure is excellent. Proprietary accelerators are available; otherwise lime and sulphate of ammonia can be sprinkled on alternate layers about 9 in. apart. Water if necessary, as very dry material will not rot. On the other hand protect the compost heap from excessive rain.

Make a separate heap of leaves from deciduous trees and shrubs. This will rot slowly to form leaf mould for potting mixtures and for mulching heather, rhododendrons, azaleas, lilies, etc.

New Sections

Soil on new sections is rarely in good condition, and to make it suitable for garden plants every effort should be made to clear weeds and improve drainage and soil texture before planting. Attend to faulty drainage first. Where possible, repeated mechanical cultivation such as with a rotary cultivator will break up the ground (making it easier for planting) and kill off weeds. Where cultivation is not possible the use of chemical weedkillers should be considered. A mixture of 10 lb of dalapon and 5 lb of amitrol to the acre (2 oz of dalapon and 1 oz of amitrol to 60 square yards) or proprietary mixtures according to manufacturer's instructions sprayed on the foliage is fairly effective in killing off most grasses and broad-leaved weeds which have grown since the section was originally cleared. Weeds will soon invade the bare ground if it is not sown or planted.

Owners of new sections who are impatient to grow trees and shrubs to enhance the appearance of their property should realise that thorough preparation of the ground ensures that the plants will grow vigorously. A tree planted without first digging deeply and incorporating compost and phosphatic manure will often remain small and stunted. Healthy trees already growing on the site should be retained if possible.

There is a common conviction that the soil of new sections is virgin and therefore fertile. Unfortunately, many soils are seriously lacking in plant foods and as a result growth is disappointing. Results will normally be better by the application of moderate to heavy dressings (4 to 8 oz to the square yard) of a balanced fertiliser containing nitrogen, phosphates, and potash. Agricultural lime should be applied for those crops which require it, remembering that many decorative plants dislike lime.

Rock Gardens

Rock gardens can be an attractive feature of hillside gardens, particularly where there are natural outcrops of scoria or other rocks. In pumice districts this material is very useful, as it retains moisture. Crushed pumice or scoria mixed with soil is suitable for scree-plants and all those needing perfect drainage.

In colder parts of the country alpine plants are successfully grown, and the range of these is now very great. They can be seen in public and private gardens in Christchurch and Dunedin. The majority of these plants do not thrive in the mild wet winters of northern New Zealand, yet many sections favour the use of dwarf or prostrate plants. Among these are:

[*Sparrow*

Dwarf plants make ideal tub plants. Frost-tender types such as citrus can be brought under cover in winter. Conifers such as *Chamaecyparis obtusa nana* (above) are hardy, though the unglazed earthenware bowl can be damaged by frost.

Bulbs such as lachenalia, ixia, babiana, freesia, cyclamen, muscari, tritonia, *Narcissus bulbocodium* (hoop petticoat).

Succulents such as echeveria, crassula, sedum, mesembryanthemum, aloe.

Dwarf and trailing herbaceous plants, such as heuchera, *Campanula portenschlagiana*, pinks, euphorbia, oenothera, gazania, arctotis, ivy-leaved geranium.

Ground orchids, such as bletilla, pleione.

Ferns.

Dwarf and trailing shrubs such as adenandra, selago, dwarf azaleas, boronia, *Phyllica plumosa*, *Grevillea lavandulacea*, lantana, pimelia, thyme, rosemary, *Convolvulus mauretanica*, fuchsia 'Tom Thumb', and others; *Cuphea ignea*, *C. micropetala*, *Prunus triloba*, *P. glandulosa*, *P. glandulosa* 'Flore-plena'; epacris, *Erica cavendishiana*, helianthemum, cistus, felicia, cytisus, dwarf maple, *Cotoneaster horizontalis*, and dwarf and prostrate conifers.

House Plants

Reduce the frequency of watering and feeding of house plants except for winter flowering types. Do not repot or propagate, as little new growth of shoots or roots will be made until spring.

Group plants as required to provide interesting decorations through winter. If new purchases are contemplated, choose plants which are not only suitable for light and temperature conditions that can be provided, but which will enhance the beauty of the existing house plants by pleasant contrasts of colour or form.

New plants will require a period of acclimatising, particularly if they have been grown in a glasshouse. They frequently respond to the colder, drier atmosphere of a house by dropping leaves. Reduce the watering, place among other plants, and maintain a humid atmosphere round the plants until they begin to grow again.

Specimen plants, standing alone in a room, look more attractive if the flower pot is placed inside a decorative container. Small unglazed earthenware bowls or crocks are most suitable and small trees or shrubs can be planted directly in them. Pottery enthusiasts will be able to turn their hobby to good use. Small wooden tubs or half casks are useful for dwarf bamboo, pomegranate, orange, pine, and many other ornamental trees.

Floral Decorations

The warmer colours (yellow, red, orange, and apricot) are lovely in autumn and winter, some of them glowing under artificial light. Flowers in the home are likely to be seen and appreciated more during dull winter days, so it is worth taking extra care in selecting and arranging them, particularly those on the dining table, which are under closer scrutiny. Short-stemmed winter flowers such as violets and primroses look well when bedded into moss. Height can be gained by using lichen-covered branches, driftwood, or a bare branch of willow, maple, or pine, from the base of which the small flowers appear to grow.

WHAT SHOULD YOUR CHILDREN EAT?

By JUDITH FERRIER,
Home Science Instructor, Department of Agriculture, Christchurch

IS it right for them? This is one question all mothers ask themselves about food for children. A child's eager "More please, Mum" soon shows his favourite foods, but how often and why is a half empty plate pushed away?

ASSUMING that the child does not actively dislike a food, there could be several reasons why he just doesn't want it, and many an unwanted dinner has disappeared rapidly with a little bribery!

The fault may be with the way in which it is presented rather than with the food itself.

Colourful food combinations appeal to children. They prefer their food plain rather than overfussed. Preparing different dishes for the young and old in a family is seldom necessary, as the simply cooked dishes for children can be dressed up to suit adult palates with seasonings and more strongly flavoured foods.

Eating essentially the same as the others at the table will give the children a feeling of being grown up, will encourage their interest in food, and should promote good eating habits. But these depend on those of the adults, for a child will rebel at being forced to eat something he doesn't care for while an older person can sit opposite pushing aside liver or greens.

Many of the so-called dislikes are copies.

Concluded Next Month

"WHAT SHOULD YOUR CHILDREN EAT" is being published in two parts. The concluding part, which will deal with sources of minerals and vitamins, will appear in next month's issue.

Prejudice against certain foods may result from the way they have been cooked. Raw vegetables can be encouraged, as they are a better source of minerals and vitamins than are vegetables improperly cooked.

Green vegetables need only a very short cooking time to make them tender. Put them into a little salted water **when it is boiling**. Cook quickly with the lid on and there should be not much liquid left.

No child can be expected to show enthusiasm for cabbage put on to cook at the same time as the root vegetables and left to stew for up to half an hour, by which time it is completely waterlogged and more yellow than green. Quick cooking, not soda, is the way to preserve the greenness.

Drain it thoroughly. Food loses appeal if it is served soggy with fat or water.

Value of Liver

Liver is another food which is enjoyable only if it is cooked correctly. It will not be leathery or "mealy" if it is cut in $\frac{1}{4}$ in. slices, dipped in seasoned flour, and fried quickly in hot butter or bacon fat **over a medium heat** for not more than three to four minutes. However, to be really appetising liver

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— said
Mr. J. W. McConnon,
when Chairman of
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must be properly prepared by having the skin and vessels removed before it is sliced.

An easy way to skin the liver is to nick the surface. lift the skin with the point of a knife, and work the fingers underneath across the whole surface to remove the skin in one or two pieces. Pouring boiling water over the liver to facilitate skinning it is not recommended, because it toughens the surface. The vessels can be removed as the slices are cut.

Alternatively it can be completely disguised as a meat loaf to defy detection by even the most convinced liver hater.

Liver Loaf

1 lb of liver, skinned and sliced
1 medium onion
½ lb of sausage meat or sausages (skinned)
1 cup of dry breadcrumbs
1 tablespoon of Worcestershire sauce
½ lb of bacon, sliced
1 tablespoon of lemon juice or tomato sauce
1 teaspoon of grated lemon rind (if available)
1 teaspoon of salt
½ teaspoon of pepper
2 eggs

(6 to 8 servings)

Cook the liver slices in three-quarters of a cup of simmering salted water for about five minutes. Drain and reserve the liquid. Put the liver and onion together through the mincer or chop them **very** finely. Mix with all the other ingredients except the bacon and add the liquid as required. Blend well and press into a loaf tin. Top with bacon slices and bake at 350 deg. F for 45 minutes. If desired, the bacon can be minced with the liver; the loaf is then topped with a mixture of buttered crumbs and chopped parsley.

The main contribution of liver to the diet is the iron which it supplies to maintain a rich blood supply promoting growth and for the prevention of simple anaemia with the accompanying tiredness and listlessness.

Whole grain cereals, legumes, heart, kidneys, well cooked green vegetables, and cocoa also supply iron in less amounts.

Egg yolk is another very rich source of iron and for this reason is one of the first foods fed to the very young baby to supplement milk, which has relatively little iron. The new born baby has a stored supply of iron received from the mother during pregnancy, but by the age of six months this supply has been used up, as the greatest need for iron comes at the periods of fastest growth and development, from six months to two and a half years and during adolescence.

Appealing Meals Should be Aim

All foods, no matter how nutritious, are useful only if children will eat them, which makes mother's most important task producing appealing meals that will sell themselves. Children are bound to develop dislikes. Fussing and forcing these foods to be eaten will draw attention to the situation and make the "coming round" process much longer.

There are very few foods which cannot be substituted by others to provide the same nutrients in a much more pleasant atmosphere. The varied sources of iron show this clearly.

Emphasis should be on a variety of foods enjoyed rather than on the value of any one food and what is lacking at one meal will be balanced at another.

The amount of food children need differs widely with the individuals, their age, their rate of growth, their appetite, and their activity. Overweight with adults in New Zealand is a problem often attributed to mother's good cooking and having eaten too much of it.

The same can usually be applied to overweight children. It is unwise to encourage the eating of large meals and always cleaning the plate if they do not want the food, especially if bribery with lollies to follow is used to achieve this end. No child will allow himself to starve. A small to moderately sized portion, followed by a second helping if it is asked for, is a better policy to pursue.

Between-meal Snacks

Discourage between-meal snacks, especially for children who "pick" at meal times. The in-betweens may be the reason for the picking. However, where there is a definite need for something to eat between meals—after they have had a tiring school day or a long ride home in the bus—try to provide something which will add to the diet rather than detract from it, as sweet biscuits, cakes, and lollies do.

Fruit, plain biscuits, crisp bread and cheese, or a peanut butter sandwich with a glass of milk or a milk shake are good suggestions for stopping the hunger pangs.

Milk Shake

2 teaspoons of chocolate syrup
Or
¼ glass of fruit squash
Or
¼ glass of syrup from preserved fruit
Chilled milk to fill the glass (fresh or powdered milk)
Nutmeg (if wanted)

(1 serving)

Combine in a mixer or with the egg beater. Or combine in a shaker and shake until frothy. The squash or syrup flavours the milk and thickens it slightly. Too much fruit flavouring will curdle the milk. Top with a sprinkle of nutmeg.

Chocolate Syrup

½ cup of cocoa
1 cup of sugar
½ teaspoon of salt
1 cup of water

Combine. Bring to the boil and cook gently, stirring frequently for five minutes. Stir in half teaspoon of vanilla if desired. Cool and store in refrigerator or keep covered in a cool place. Use two teaspoons to each glass of milk and serve hot as cocoa or cold as a milk shake.

Fruit Squash

4 to 8 lemons, oranges, or grapefruit, depending on size and juiciness
3 pints of water
1½ to 2 lb of sugar
1 oz of citric acid

Grate the rind from the fruit and boil in the water for 10 minutes. Add the sugar and stir until dissolved. Cool. Add the citric acid and the fruit juice. Bottle and use diluted with

Slim Anna says;

Oranges

are so kind to *figures*...

All figures, she means . . . Those on the watchful bathroom scales, the tell-tale ones of the measuring-tape and, of course, your own vital "vital statistics" — which decide whether you look and feel your best. Oranges eaten whole between meals restrict your appetite for high-calorie fat-forming foods. Besides being delicious, they are rich in protective and tonic properties — Vitamin C, protopectins to improve digestion, inositol to guard the liver from harmful deposits, bioflavanoids to tone up the capillaries (tiny blood vessels) and Pro-vitamin A for eye and skin health.

MAKE ORANGES
YOUR
DIET ALLY

water or milk. A mixture of fruits makes a pleasantly flavoured drink and is a useful way of using the crop in areas where these fruits are plentiful.

Black Currant Squash

5 lb of black currants
3 quarts of water
4½ oz of tartaric acid
Sugar

First Extraction

Dissolve 2½ oz of tartaric acid in 1 quart of water. Pour over the fruit in a china, glass, or enamel bowl. Allow to stand covered 24 hours. Strain through muslin. Cover juice and put aside in another basin.

Second Extraction

Put fruit back into the first basin. Dissolve 2 oz of tartaric acid in 2 quarts of water and pour over the fruit. Cover and allow to stand 24 hours.

Combine the two lots of juice, measure, and bring to the boil. Remove from the heat and stir in 1½ lb of sugar for each pint of juice until it is dissolved. Cover and leave overnight. Bottle in sterilised bottles, leaving 1 to 2 in. headspace. Cork firmly. Lay bottles in a saucepan. Cover with hot water. Bring to 180 deg. F and hold for 20 minutes. Cool. Seal with paraffin and store in a cool place.

Small bottles (about 10 to 12 oz) are best, as the squash should be used within about a week of being opened. Use diluted with milk or water or as a sauce over ice cream or puddings.

Oat Flatties

4 oz of butter
4 oz of sugar
2 oz of flour
1¾ cups of rolled oats
2 teaspoons of baking powder
1 egg
½ teaspoon of salt
½ teaspoon of vanilla essence
Or
2 teaspoons of marmalade

Mix the dry ingredients in a basin.

Melt the butter in a saucepan. Stir in sugar, egg, and flavouring. Combine liquid and dry ingredients in the basin.

Place in teaspoon lots on a greased tray. Bake at 300 to 325 deg. F for 15 minutes. Cool and store in an airtight tin.

Crisp Bread

Slice stale bread thinly (not more than ¼ in.) and bake 30 to 45 minutes in a slow oven (325 deg. F).

Cheese Spread

1 tablespoon of soft butter and
1 tablespoon of scalded milk
Or
2 tablespoons of scalded milk instead
1 cup of grated cheese
Salt and pepper
¼ cup of chopped nuts (optional)

Grate the cheese. Mix with seasonings and nuts. Add the butter and hot milk and work smooth with a knife. Chill if possible. To use as a sandwich filling add a little more scalded milk to give a softer mixture. Use unchilled.

Contrary to popular belief, cheese is a suitable food for children from one year old, but it is wise to avoid the more mature and highly flavoured cheeses.

[Sparrow

Children love to compare their lunches and to swap "specials". An adequate lunch will provide about a third of the day's food requirements.

Most country children have a long school day and need a snack of this type when they arrive home, especially if they have to take a packed lunch.

The lunch box is a new problem each morning, with the choice of foods comparatively limited. They must travel well, give best value for the space they take up, and provide variety in flavour, texture, and colour. Children love to compare their lunches and swap specialities, but if they are given an interesting lunch, there is more chance that it will be eaten by the owner.

Sandwich Suggestions

Use day-old bread with the crusts left on. Pack white and whole meal sandwiches or use a slice of each to make them two tone. Bread cut thicker than ¼ in. will mask the flavour of the filling, which should be the important part. If the knife blade is heated under hot water and dried, the bread is more easily sliced.

Neatly cut sandwiches can be achieved if the filled slices are piled up and cut from the centre to the outside, using two cuts rather than cutting flat down through the pile in one operation.

Softened butter creamed with a few drops of hot water is easily spread and goes further. Suitable flavourings and herbs can be creamed with the butter to complement and give added piquancy to the filling. These butters should be allowed to stand for 30 minutes before use to develop the fullest flavour.

Lemon Butter

2 oz of softened butter
1 tablespoon of lemon juice
1 teaspoon of grated lemon rind

Cream together.

Use with fillings made from fish, dried fruits, banana.

Savoury Butter

2 oz of softened butter
1 to 1½ teaspoons of prepared mustard
Or
2 teaspoons of soft chutney or relish chopped finely if necessary

Cream together.

Use with meat fillings.

Mint Butter

2 oz of softened butter
1 tablespoon finely chopped mint

Cream together.

Use with fillings of lettuce, fresh and dried fruits, cheese or cucumber.

As the lunch must supply about a third of the day's food requirements, it should be a well balanced meal which includes the protective foods (mainly proteins) to build and maintain a healthy body as well as the energy-giving foods—fats, sugars, and cereals—to provide energy for immediate activity. Emphasis should be on the protective foods, as their effect is more long reaching and they will supply energy as well. During periods of greatest growth the protective foods become even more important.

WHAT SHOULD YOUR CHILDREN EAT? . . .

Sandwich fillings are usually the means of providing the protective foods in a lunch.

Meat, fish, milk, eggs, and cheese are the most valuable of the protective foods. Others which make a definite contribution are fruit and vegetables, legumes (peas and beans), cereals, and nuts. This range provides scope for a variety of fillings.

Home-freezer owners can prepare sandwiches or fillings in quantity and freeze them for future use, but there are several fillings which will keep well in the refrigerator or a cool safe if they are made ahead in reasonable quantities. The following suggestions will inspire others, depending on what is in the kitchen cupboards.

Savoury Fillings

1. Yeast or meat extract with chopped walnuts.
2. Softened, creamed cheese with a choice of the following blended in: Crisp, cooked bacon bits, minced ham, salted peanuts, chopped celery or green pepper, and chopped chives or parsley.
3. Shredded lettuce and mint.
4. Peanut butter with chopped, cooked bacon and sweet pickle moistened with salad dressing.
5. Sardines or salmon flaked with a little salad dressing and mixed with chopped, hard-cooked egg.
6. Peanut butter with thin slices of ham.
7. Softened creamed cheese with sliced cucumber.
8. Cottage cheese with finely chopped parsley.
9. Minced roast mutton with mint jelly.
10. Minced roast poultry with a little marmalade.
11. Minced roast pork with shredded apple and mint.
12. Minced roast beef blended with cold mashed potato moistened with tomato sauce.

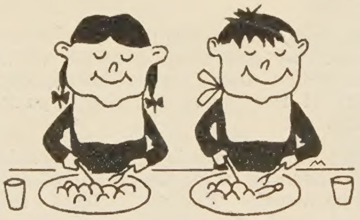
Sweet Fillings

1. Chopped dried fruits with marmalade.
2. Peanut butter mixed with chopped apple and moistened with orange juice.
3. Finely sliced crystallised ginger in brown bread.
4. Raisins with plenty of chopped mint.
5. Softened cheese with chunky marmalade or conserve.
6. Grated carrot and a few sultanas moistened with lemon juice.
7. Softened cheese with chopped, drained pineapple.
8. Mashed banana moistened with lemon juice. Add some chopped-up chocolate.
9. Blackberries lightly crushed with orange juice.
10. Lemon honey with grated tart apple.
11. Thick honey or peanut butter with chopped nuts and dates.
12. Cottage cheese and chopped tart jelly or stiff jam.

Meat Spread

1 teaspoon of chopped onion
1 blade or a few grains of mace
1 bay leaf
3 to 4 peppercorns
1 cup of milk
2 tablespoons of butter
2 tablespoons of flour
1 teaspoon of salt
Few grains of pepper
¾ lb of liver
¼ lb of fat bacon
5 to 6 drained sardines
Or
1 teaspoon of anchovy essence or paste
3 to 4 rashers of streaky bacon

Simmer onion, mace, bay leaf, and peppercorns in the milk for five minutes. Strain and use the milk to make a roux sauce. (Melt butter; blend in flour, salt, and pepper. Add milk slowly, stirring until thick. Boil two to three minutes.) Mince the liver and fat bacon three times with the sardines or essence. Blend with the sauce. Line an ovenproof bowl with bacon rashers and pour in the mixture. Cover the top with greaseproof paper tied on firmly. Place in a pan of water and bake 45 to 60 minutes in a moderate oven. Cool. Press lightly with a weighted plate until cold. Turn out and use as a sandwich filling or on crisp thin toast.



Autumn is Pickling Time

WHEN vegetables are young, tender, and in good supply some may be preserved for future use.

When the demand for bottling, canning, or deep-freezing has been satisfied and the vegetable supply assured, a little time can be given to those extras which can change a meal from something that must be stoically endured to one that is looked forward to with pleasant anticipation. The following is a recipe for piccalilli that is easily and quickly made. Vegetables may be varied to suit availability and individual preference, but the total weight should be kept the same. It is advisable not to use a copper or brass preserving pan.

Piccalilli

1 lb of onions
1 lb of marrow
1 lb of cauliflower
1 medium cucumber
¾ lb of french beans
¾ lb of salt (approx.)
1¼ oz of flour
1½ oz of mustard
½ oz of turmeric
4 oz of sugar
2 pints of vinegar

Prepare the vegetables. Slice the onions thinly. Dice the marrow. Cut the cucumber into small pieces and the beans in inch-long pieces. Break the cauliflower into small sprigs and wash thoroughly.

Place in a bowl and sprinkle well with salt. Leave for 24 hours, then drain thoroughly.

Mix together the flour, mustard, and turmeric, and blend with a little vinegar. Boil the vegetables in the rest of the vinegar and sugar for 20 minutes. Stir in the flour-spices mixture and boil for three minutes. Bottle andco ver.

—*MAUD B. STRAIN,*
Home Science Instructor,
Department of Agriculture,
Dunedin

◆

Rhubarb Chutney

RHUBARB, which grows profusely in many home gardens, is the basis of this tasty and unusual chutney. It is an ideal accompaniment with cold meals.

Do not be surprised at the large quantity of garlic in the recipe; it can be omitted, or you could substitute onion if you object to the taste, but the garlic gives a subtle flavour which makes this quick and easy chutney a family favourite.

Rhubarb Chutney

2 lb of finely chopped rhubarb
1 lb of sultanas
2 lb of sugar
2 finely chopped lemons
2 oz of crushed garlic
1 oz of salt
1 oz of root ginger
1 pint of vinegar

Combine all ingredients in a saucepan except the root ginger. Tie this in a muslin bag and beat it with a hammer to bruise the ginger and allow the flavour to escape. Put the bag in the pan and boil all together till thick, 45 to 60 minutes. Take out the ginger. Pour into sterilised jars. Cover when cold.

—*NAOMI F. BANKS,*
Home Science Instructor,
Department of Agriculture,
Auckland

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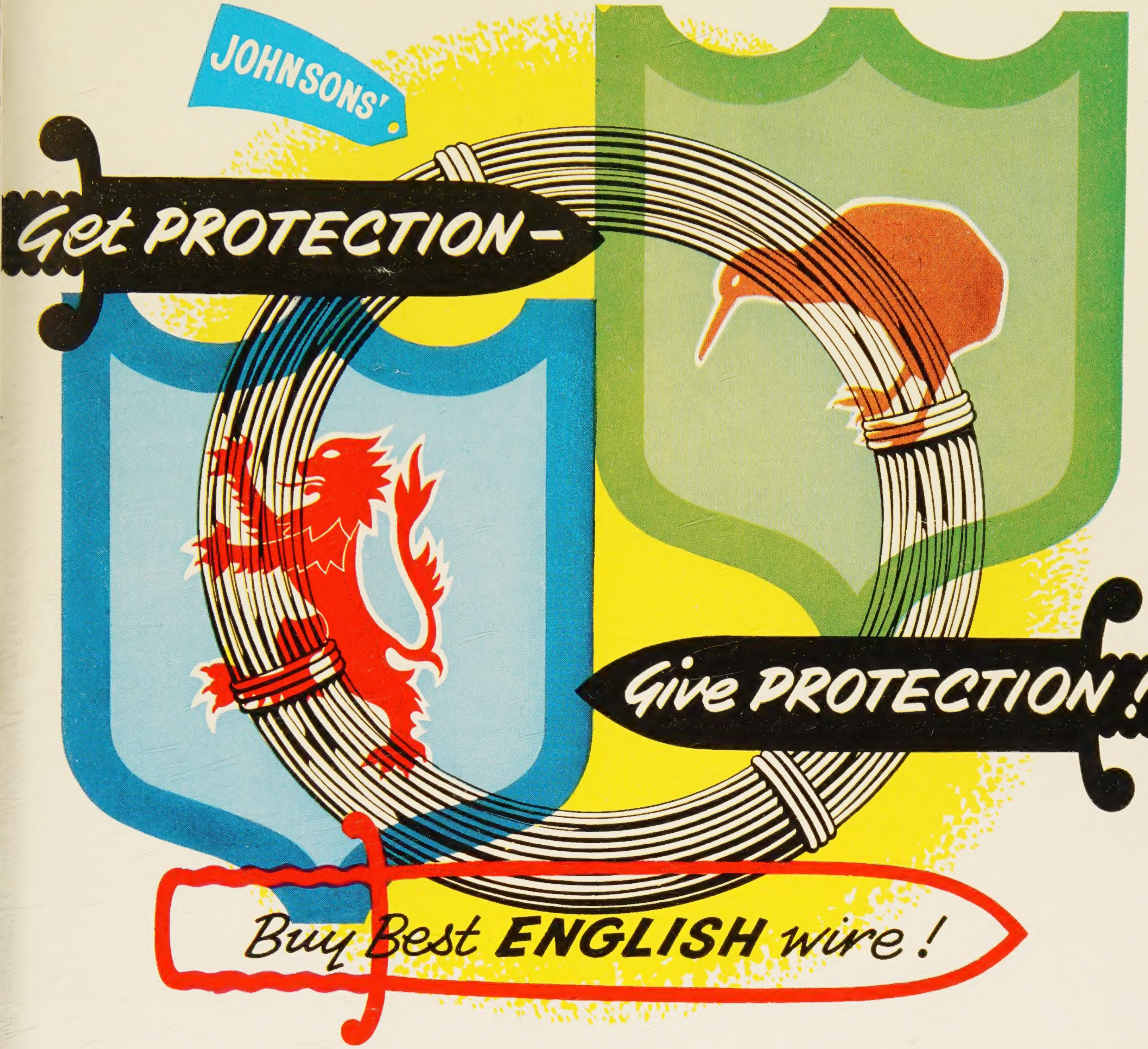
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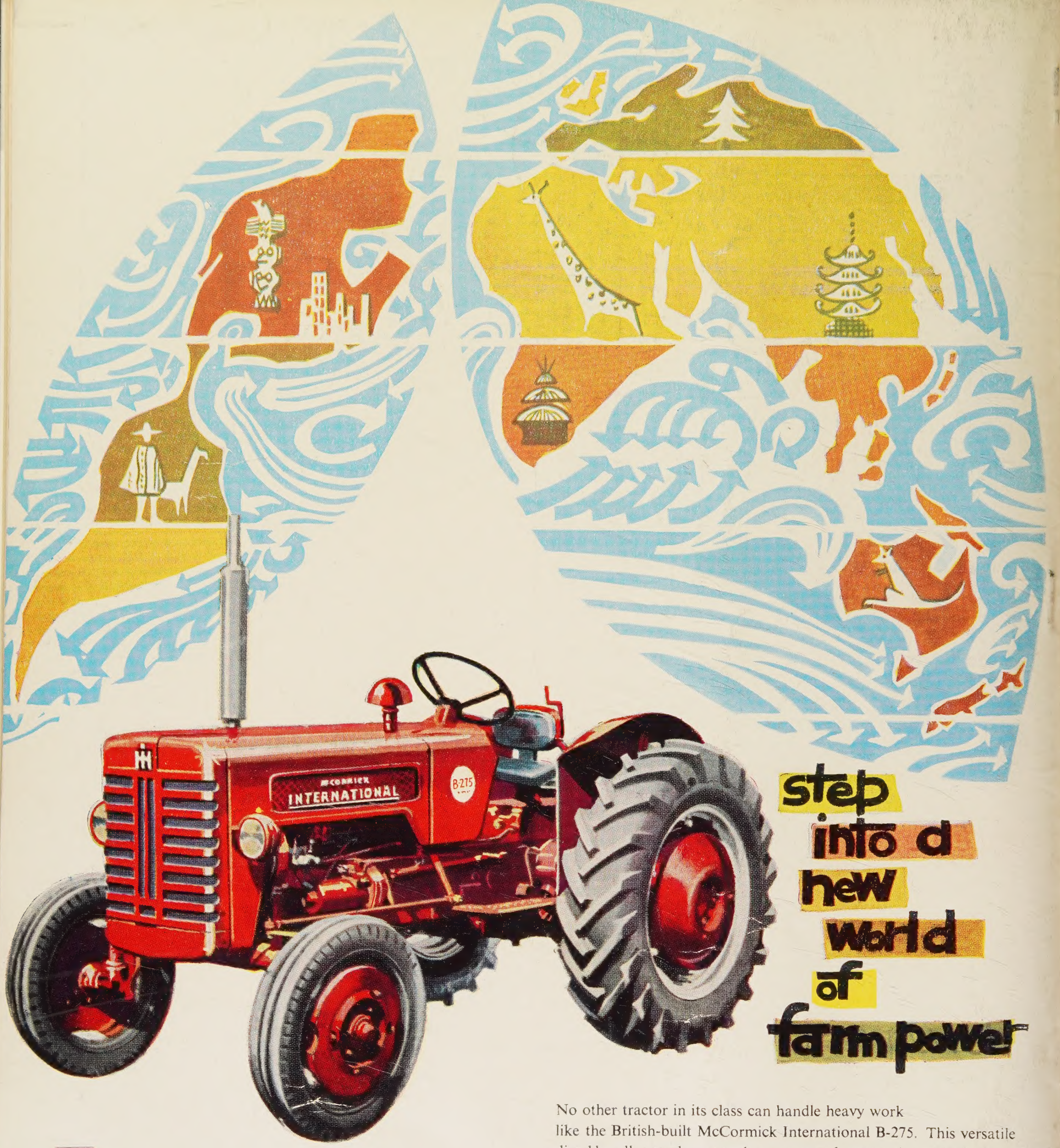
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